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SPECTRAL ANALYSES OF WAVES AND ASSOCIATED BOTTOM PRESSURES OFF POINT SUR, CALIFORNIA

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SPECTRAL ANALYSES OF WAVES AND ASSOCIATED BOTTOM PRESSURES OFF POINT SUR, CALIFORNIA

by

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN OCEANOGRAPHY

from the

NAVAL POSTGRADUATE SCHOOL
June 1968

NPS Archive
1968
Steele, B

~~RRD~~ S67877 c.1

ABSTRACT

A time series of pressure variations was obtained by digitizing analogue records of bottom pressure, recorded at Pt. Sur, California, during the periods November, December, and January, 1947-1948, and June, July, and August, 1949. The power spectrum of the pressure variations was found via the amplitude spectra obtained by means of the fast Fourier transform. This spectrum was then smoothed by averaging over several frequency bands and confidence limits were assigned.

Surface wave power spectra were inferred from the pressure power spectra and significant wave heights were estimated from these, after applying a procedure designed to remove noise.

Values of significant height on the bottom and at the surface are displayed in tabular form and plotted versus time for the selected periods January, 1948, and August, 1949. The spectral patterns of wave activity show the transient nature of the energy due to storm swell and local winds.

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TABLE OF SYMBOLS AND ABBREVIATIONS

Symbol	Definition	Unit
f_{max}	the maximum frequency about which the analysis can gain information	$sec.^{-1}$
t	time	sec.
Δt	sampling interval	sec.
Δf	$1/\Delta t$, elementary spectral band width	$sec.^{-1}$
E	energy	$ft.^2$
A_k	pressure amplitude	ft.
M	number of observations	
HARM	IBM computer subprogram, a fast Fourier transform	
$\hat{A}(f_j) = \hat{A}_j$	complex spectral amplitude	ft.
$f_j = j \Delta f$	frequency of Fourier amplitude	$sec.^{-1}$
$t_k = k \Delta t$	time of the pressure data point	sec.
B_j	Energy in band width Δf	$ft.^2$
m	arbitrary number of band widths	
B_l	average spectral amplitude in band width $m \Delta f$	$ft.^2$
f_l	approximate class frequency	$sec.^{-1}$
l	$= m/2, \frac{3m}{2}, \frac{5m}{2}, \ldots, M - \frac{m}{2}$	
$\bar{S}(f_l)$	average energy density in band width $m \Delta f$	$ft.^2$-sec.
Δx	incremental horizontal value of the digitizer	ft.
Δy	incremental vertical value of the digitizer	ft.
x_i	summation of the Δx for the i^{th} position in time	ft.

Symbol	Definition	Unit
y_i	summation of the Δ y for the i^{th} position in time	ft.
R	radius of the ordinate on the wave record	ft.
Rθ	measure of arc length	ft.
H3B	significant height of pressure amplitudes measured at the recorder (in this case on the bottom)	
H3S	significant height of the surface waves	
PCT	Pacific Coast Time	date/ hours/ minutes
var	variance	$ft.^2$
N	degrees of freedom	

ACKNOWLEDGEMENTS

The author wishes to express appreciation for the advice and encouragement of Professor J. B. Wickham under whose direction this study was carried out.

In addition, the author is indebted to Lieutenant Commander G. M. Griswold, USN, and Lieutenant N. L. Perkins, USN, of the Fleet Numerical Weather Facility staff, for assistance in programming and for suggestions which were incorporated into this study.

Appreciation is also expressed to Captain P. M. Wolff, USN, Officer in Charge, Fleet Numerical Weather Facility, who made available the CDC 6500 computer used in part for this study.

I. Objectives

The randomness of the sea has puzzled investigators for centuries. Before forecasts of the behavior of the sea can be made, there must exist a more complete knowledge of the many-faceted energy relationships between the air and the sea. Most modern authorities feel that the true behavior of the sea can be best approximated by considering the behavior of each of its spectral components.

In addition, with the increasing use of major structures situated on the sea floor, it becomes more important to know about the possibility of pulsating water motions, with particular frequencies, and changes in the magnitude of the pulsations. The knowledge of bottom pressure activity is of extreme importance in mine warfare. In view of these and other needs, this paper has the following objectives:

A. To display the spectral patterns of energy density of waves and associated bottom pressures versus time for the analogue wave records recorded at Pt. Sur, California, during the periods:

   1. November, December, and January, 1947-48, (winter), and,
   2. June, July, and August, 1949, (summer).

   The spectra are to be obtained by digitizing the analogue data and performing a spectrum analysis on the resulting time series.

B. To compare the results from the summer and winter periods;

C. To provide background data for other studies, such as;

   1. Consideration of effects of shoaling and refraction in obtaining a deep water spectrum;
   2. Wave energy attenuation studies;
   3. Locating of sources of wave activity reaching the Pt. Sur area; and,

4. Examining the analysis for peculiarities such as favored frequencies that might indicate the influence of local topography.

II. Related Work

Munk, Snodgrass, and Miller (1) displayed contours of equal power density, E(f,t) on a frequency time plot and used the spectral peaks' arrival times to estimate distances to the areas of wave generation. They confirmed the relationship by determining direction and distance in a separate analysis.

The use of a digitizer to convert the analogue data of the wave records is discussed by Moskowitz, Pierson, and Mehr (2). Their records were part of the data used in "the problem of developing numerical wave forecasting procedures for the North Atlantic Ocean", now functioning as a part of ASWEPS.

III. Data Used in This Study

The wave pressure records used for this study were recorded by a University of California Mark III bottom pressure recorder, anchored on the bottom in sixty-eight feet of water, measured from MLLW. A comprehensive discussion of bottom pressure recorders and the manner in which they act as a low pass filter was presented by Munk (3). The major advantage of choosing these somewhat dated records is that they provide a long and nearly continuous history from which patterns of wave activity may be shown. Johnson (4) has also published the results of another kind of analysis of these same records.

IV. Spectral Analysis

A time series of pressure variations is analyzed using the fast Fourier transform, a technique developed by Cooley and Tukey (5), incorporated in the IBM computer subroutine HARM to obtain the amplitude spectrum. The Fourier amplitudes are then used to find the power spectrum which is smoothed by averaging over several frequency bands. The entire procedure and several associated processes have been incorporated into a computer program written in FORTRAN IV.

A basic step in the analysis is selection of a suitable sample interval. For this study the primary interest was in wind waves; and, both theory and observation indicate that, due to filtering, very little activity at depths of sixty-eight feet is found in waves of frequencies greater than 0.25 sec.$^{-1}$. The appropriate sampling interval for this frequency is $\Delta t = 2$ seconds, given by

$$f_{max} = \frac{1}{2\,\Delta t} \qquad (1)$$

The fast Fourier transform requires 2^n (n a positive integer) discrete data points for each analysis. With a 2-second sampling interval, the largest n possible was 9 (512 data points) equivalent to 17 minutes and 4 seconds.

As a check on the spectral analysis, an independent calculation of the total energy was made directly from the pressure amplitudes, by

$$E = 2\ \mathrm{var}(A_k) = 2/N \sum_{k=1}^{N} A_k^2 \qquad (2)$$

where, A_k = pressure amplitude, and,

M = 512 is the number of observations of A_k.

The Fourier series analysis, HARM, produces a complex amplitude spectrum which represents the points of the time series by the sum of

the same number of discrete frequencies. The complex amplitudes are given by

$$\hat{A}(f_j) = \sum_{k=1}^{512} A(t_k) e^{-2\pi f_j t_k} , \qquad (3)$$

where, $\hat{}$ denotes Fourier transformation,

$f_j = j \Delta f$ is frequency, and,

$t_k = k \Delta t$ is the time of the pressure data points.

The energy in each band of width Δf is proportional to

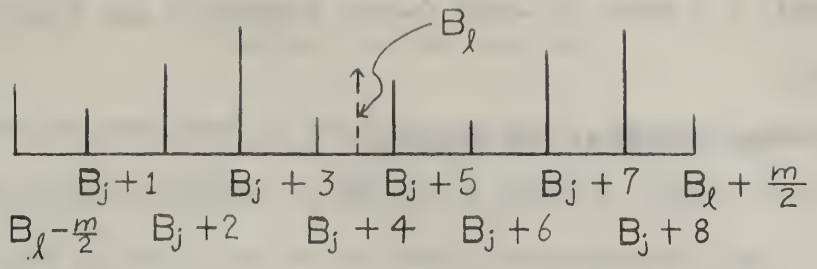
$$B_j \equiv \Delta E_j = 2 \left| \hat{A}_j \right|^2 , \qquad (4)$$

where the factor of two enters because of the symmetry of $\hat{A}_j$ about $j = 256$, and the total energy is proportional to

$$E = \sum_{j=1}^{512} \left| \hat{A}_j \right|^2 = \sum_{j=1}^{256} B_j . \qquad (5)$$

Because the sea surface disturbance is a random variable, the spectral values $\hat{A}(f_j)$ are also random variables. Thus equation (3) holds only for averaging over many realizations. The energy is also a random variable and equations (4) and (5) are only estimates of the respective energies. The confidence limits for these estimates can be determined in the manner presented by Pierson and Marks (6) and discussed here below.

The energy in each elementary band width has been determined from only two independent bits of information, and the estimates are distributed according to the χ_i^2 distribution with two degrees of freedom. By averaging a number, say m, of elementary bands of width Δf (see figure 1), one obtains an estimate of the energy which is more stable than the estimates of the contributing narrow bands.



$$B_1 = 1/m \sum_{j=1-m/2+1}^{j=1+m/2} B_j \qquad 1 = \frac{m}{2}, \frac{3\,m}{2}, \frac{5\,m}{2}, \ldots, M-\frac{m}{2}$$

Figure 1. B_1, representing ΔE in band width $m\ \Delta f$

These estimates have a χ_i^2 distribution with 2m degrees of freedom. Confidence limits may be assigned utilizing this distribution of B_1. Band averaging was done over 10 and 16 B_j. The total energy per band of width $m\ \Delta f$ was computed by

$$\Delta E(f_1) = \left[1/m \sum_{j=1-m/2+1}^{j=1+m/2} B_j \right] m = \sum B_j \ , \qquad (6)$$

where, f_1 is considered the center frequency of the band, and,

m = number of bands.

The cumulative energy was obtained by summing over m bands,

$$E = \sum_{m/2}^{M-m/2} \Delta E(f_1) = \sum_{m/2}^{M-m/2} B_1 \ . \qquad (7)$$

The average energy density in the pressure variation in the band width $m\ \Delta f$ was defined as

$$\bar{S}(f_1) \equiv \Delta E(f_1)/m\ \Delta f. \qquad (8)$$

The average energy density at the surface was then determined by

$$\bar{S}_s(f_1) = \bar{S}(f_1)/K^2, \qquad (9)$$

where K is the well known pressure response factor,

$$K = \frac{1}{\cosh 2\pi\, d/L} \ , \qquad (10)$$

where, d = depth of water (meter assumed on sea floor),

and,

L = wave length at the depth d.

V. Performing the Analysis

The wave records used in this project were analogue records of pressure variations recorded on Esterline Angus Co., Inc. chart 4313, shown in figure 2, which has curvilinear co-ordinates (t,Rθ). The records were digitized using the Calma Co. model 480 digitizer, which recorded incremental pairs, in the order, Δx and Δy (of the cartesian co-ordinates of the pressure curves), every .01 inch of stylus travel. This resulted in the wave form being approximated by a step - function, as shown in figure 3, with a secondary wave form including very high frequency energy being superimposed on the recorded wave form. This is a source of error and will be discussed further in section VI.

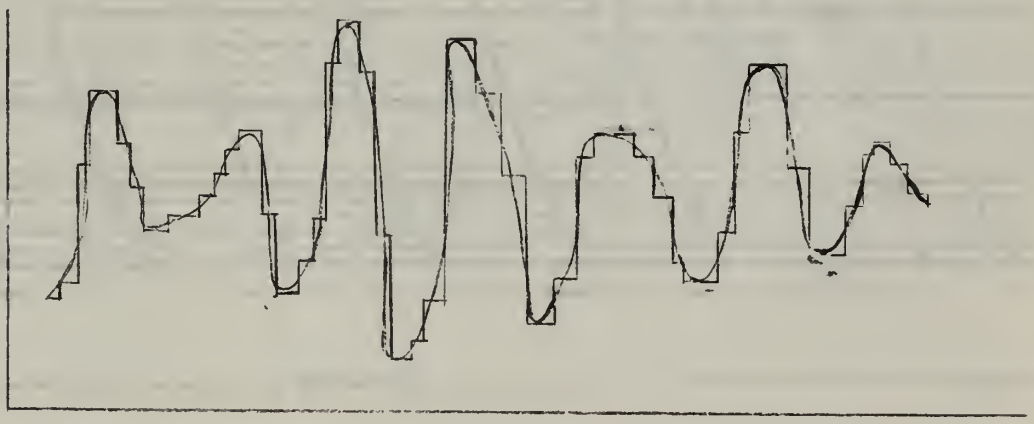


Figure 3. Steplike approximation to the recorded trace.

The digitizer recorded incremental values and it was therefore necessary to form the cartesian co-ordinates by summation within the computer. These cartesian co-ordinates were then converted to the approximately correct t,Rθ co-ordinates by employing geometric relationships.

Computation of the correct value of t_i (the time axis) was critical to the conversion. On the time scale, 0.1 inch of record was equivalent to the sample interval of 2 seconds. The summation of Δx, x_i, representing the horizontal travel, was converted to the t,Rθ co-ordinates

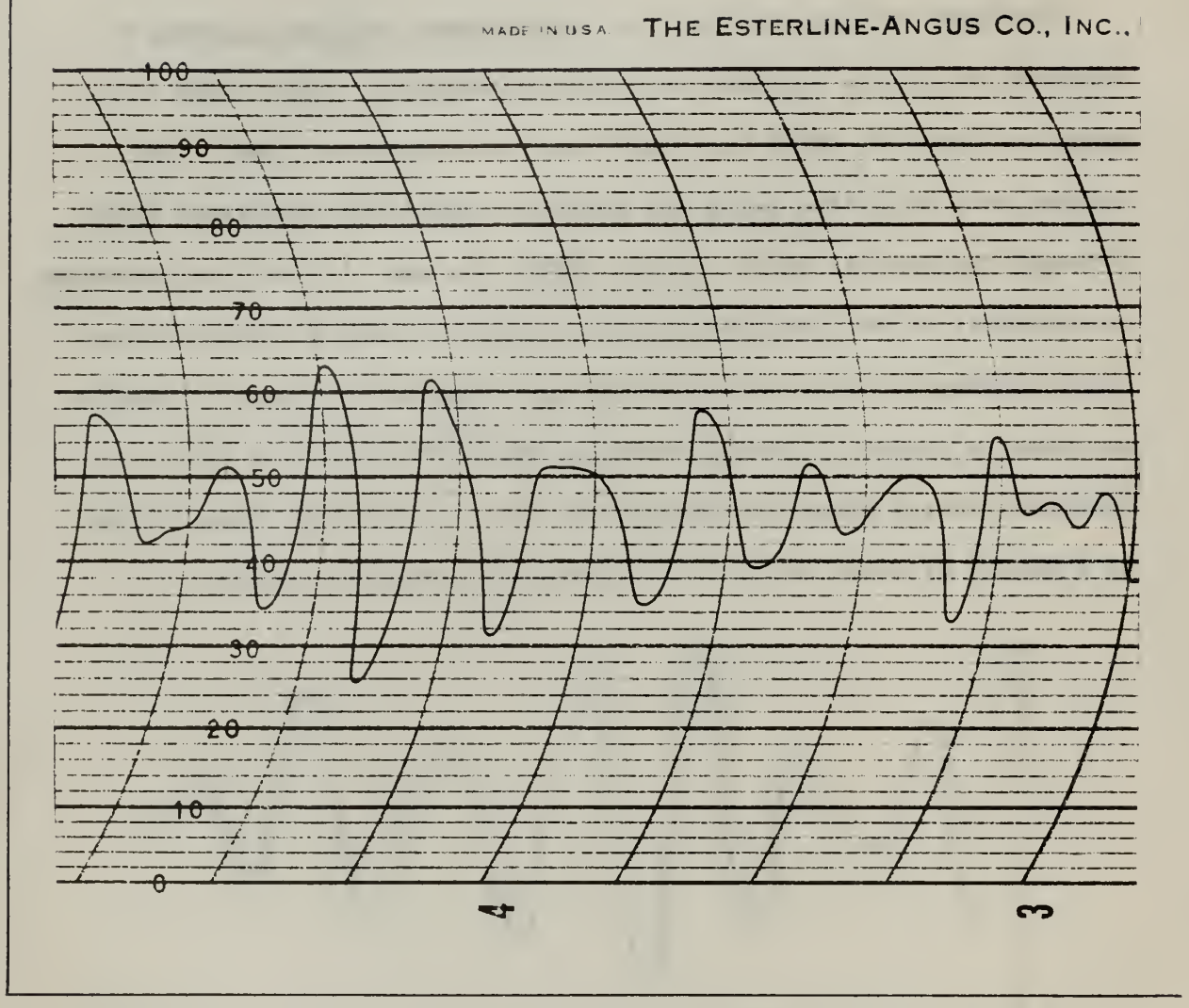


FIGURE 2. ESTERLINE ANGUS CO., INC. CHART 4313

by,

$$t_i = x_i + R - \sqrt{R^2 - y_i^2} \qquad (11)$$

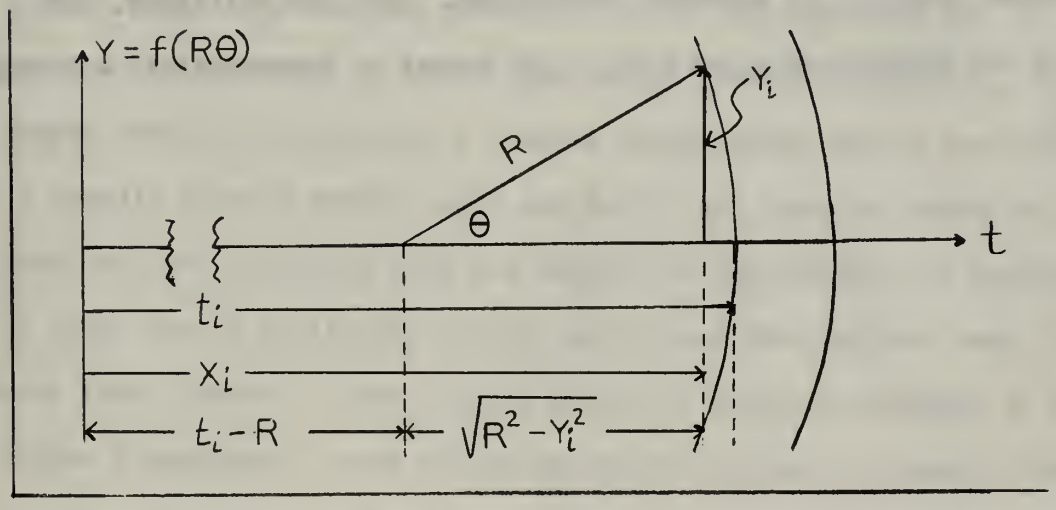
where, x_i is the time scale in equally spaced increments of Δt on the cartesian scale,

y_i is the ordinate on the cartesian scale,

t_i is the time in t,Rθ co-ordinates, and,

R is the constant radius for arcs of constant t_i.

These are shown in figure 4.



$$\theta_i = \tan^{-1} y_i / \sqrt{R^2 - y_i^2} \qquad (12)$$

Figure 4. Geometric relations for conversion to t,Rθ co-ordinates

Because 2-second intervals read by the digitizer on the rectangular co-ordinates do not in general correspond to the same interval in curvilinear co-ordinates, the following scheme was used to approximate even time steps. The cartesian amplitudes used to form the time series were extracted from the record when the value of t_i exceeded or closely approximated a separately incremented test value which represented the true position in time; i.e.,

if $t \geq test$ or if $test - t \leq .001$, then

$$y_i = y_j$$

where, i is the position in the record, and,

j is the position in the time series.

The cartesian amplitudes were then converted to arc length measured in scale units; by

$$y = R\theta \tag{13}$$

The value of R used in these calculations was determined by graphical construction. By repeated measurement, with the digitizer, the radius was determined to be $4.36 \pm .02$ inches or approximately 490 scale units.

VI. Discussion of Results

One feature of the surface spectra was the characteristic "rapid increase in the high frequencies due to the presence of noise . . ." as described by Moskowitz, et. al. (2). As indicated in section V, the digitizing procedure superimposed a very high frequency waveform on the recorded trace, the energy being aliased eventually into the frequencies used in the analysis.

An effort was made to estimate the contribution of this to the total energy. The maximum reading error of the digitizer was .01 inch on the recording or .0167 feet in the pressure amplitude. Assuming that the errors have a uniform distribution (where each event is equally likely) between zero and 0.0167 and that the errors in amplitude are not correlated with the amplitudes themselves, the contribution of noise due to digitizing appears to be less than one per cent, usually much less. However, even a small amount of noise is critical at the higher frequencies, since the energy there is also very small. Moreover, there was considerable additional noise not associated with digitizing as spectral results of non-digitized data also displayed the rise in high frequencies.

In the absence of more precise information about the total noise contribution, it was assumed that most of the energy appearing in the spectra at frequencies greater than 0.18 $sec.^{-1}$ was noise. Much of this was then arbitrarily removed in a manner analogous to that employed by Moskowitz et. al. (2), wherein it was assumed that after aliasing and smoothing over a number of spectral bands, the noise was white. The resultant determination of noise was subtracted from all spectral bands thus giving spectra with reasonable energy in the higher frequencies.

All values above 0.25 $sec.^{-1}$ indicated on computer printouts are beyond the range of the sampling interval and are spurious.

The total energy computed by the sum of the Fourier amplitudes agreed well with that found from the variance of the pressure amplitudes. The results of band averaging over 16 and 10 elementary band widths were essentially the same (in part due to the smoothing to eliminate noise); however, the greater detail expected from averaging over fewer bands was not entirely lost as can be seen from the selected samples in Appendices I and II.

The corrected values of bottom pressure spectra and inferred surface spectra were used to calculate the respective significant heights. The significant heights at the surface, for the month of January, 1948, are compared with values obtained by Johnson (4) in figure 5. Figures 6 and 7 show values of significant height on the bottom and at the surface plotted versus time for the selected periods January, 1948, and August, 1949. A tabular display of significant heights for all periods of this investigation are presented in Appendix III.

An attempt was made to determine distance to the generating area of the swell by observing the time lags between spectral peaks of increasing frequency, as done by Munk et. al. (1). Figures 8 and 9 are contours of equal power density, drawn for the characteristic of the logarithm of the spectral component of energy density (N = 32) at the surface. The very steep slopes are indicative of a relatively close storm area. This would be expected for the winter months. The summer months show no significant patterns either, perhaps due to the smoothing. In Munk's investigation a much more sensitive pressure recorder was used (vibratron developed by F. E. Snodgrass). The great amount of correlated

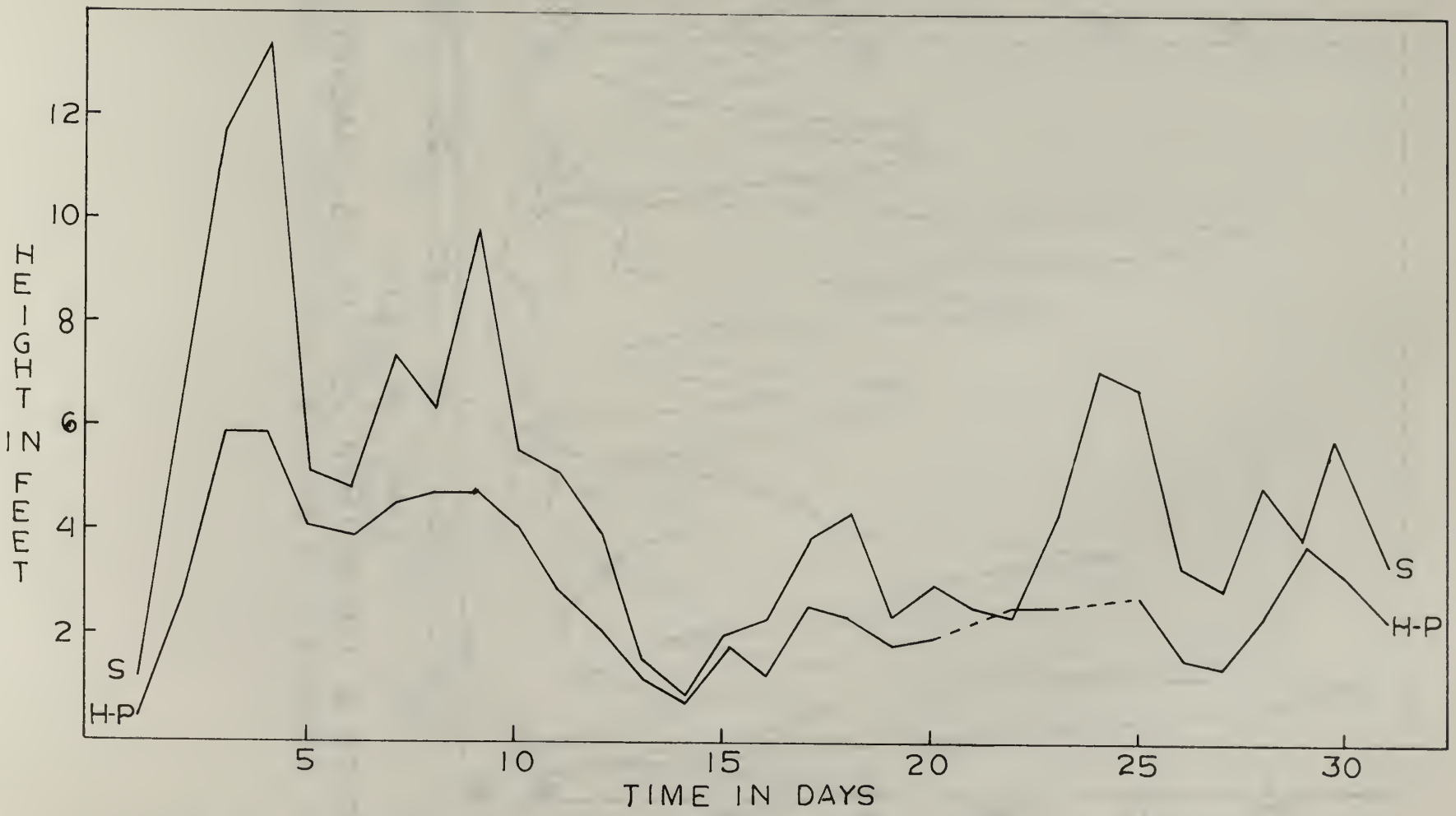


FIGURE 5. COMPARISON OF HEIGHT-PERIOD AND SPECTRAL VALUES OF H3S FOR JANUARY, 1948.

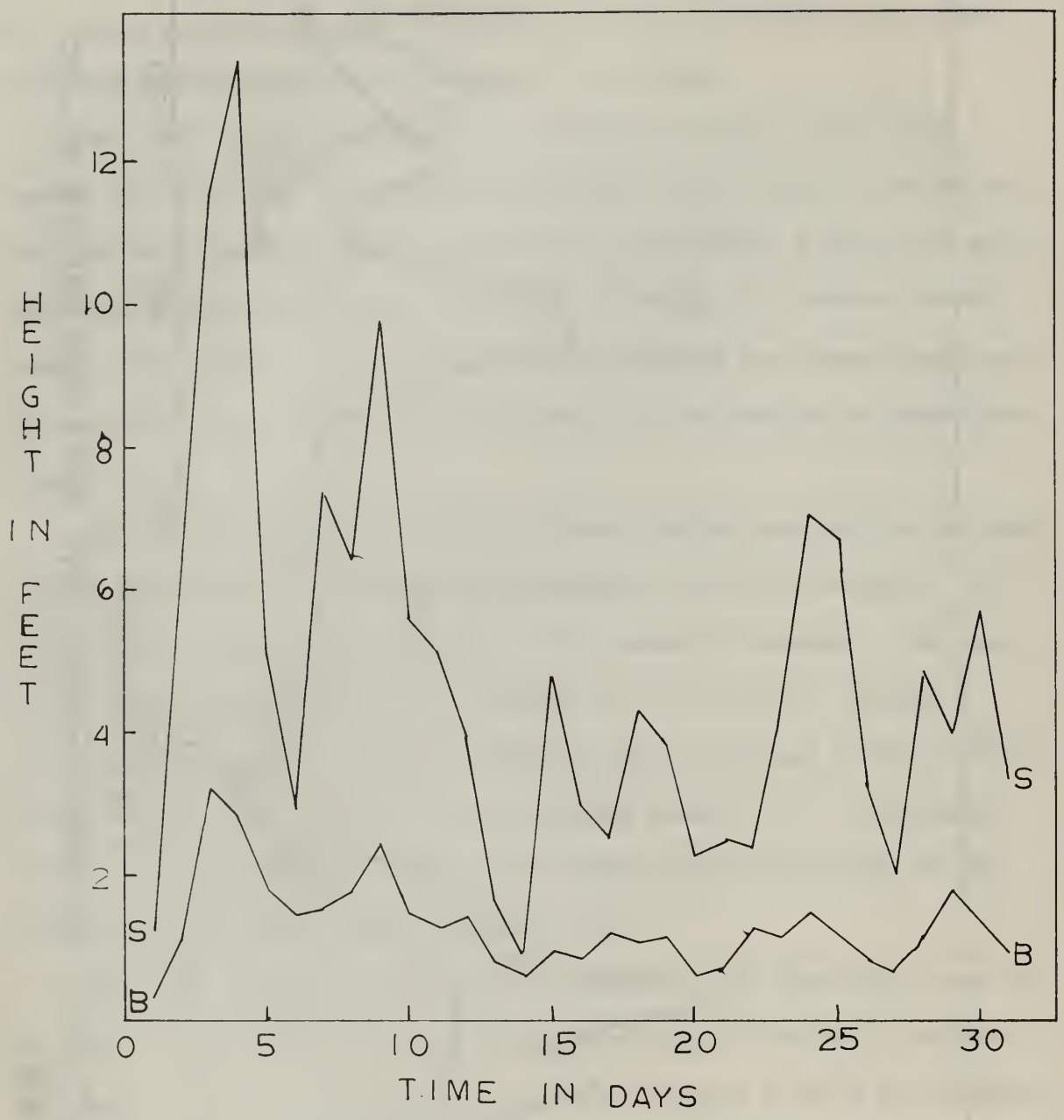


FIGURE 6 H3S AND H3B VS. TIME FOR JANUARY, 1948

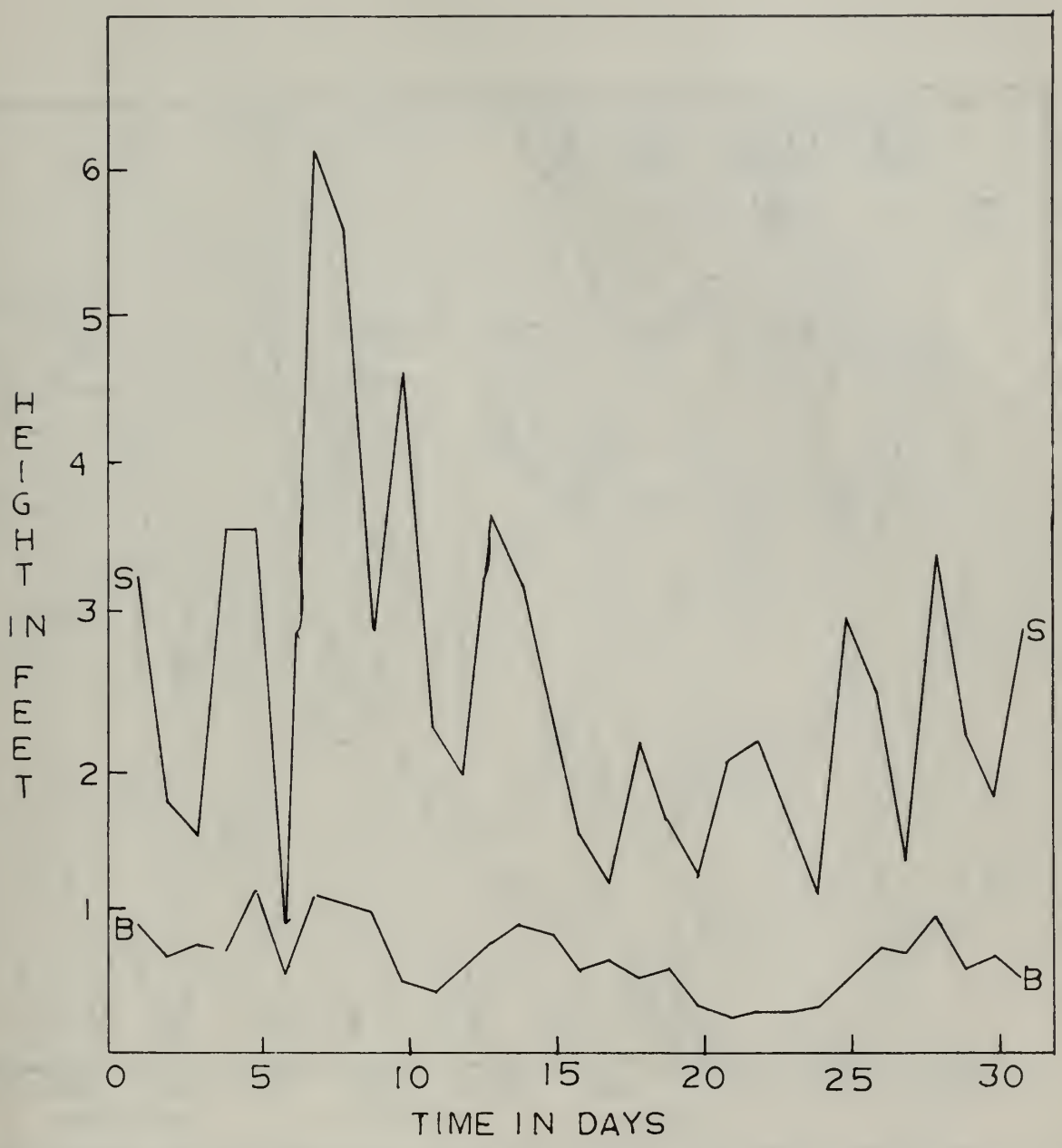


FIGURE 7. H3S AND H3B VS. TIME FOR AUGUST, 1949

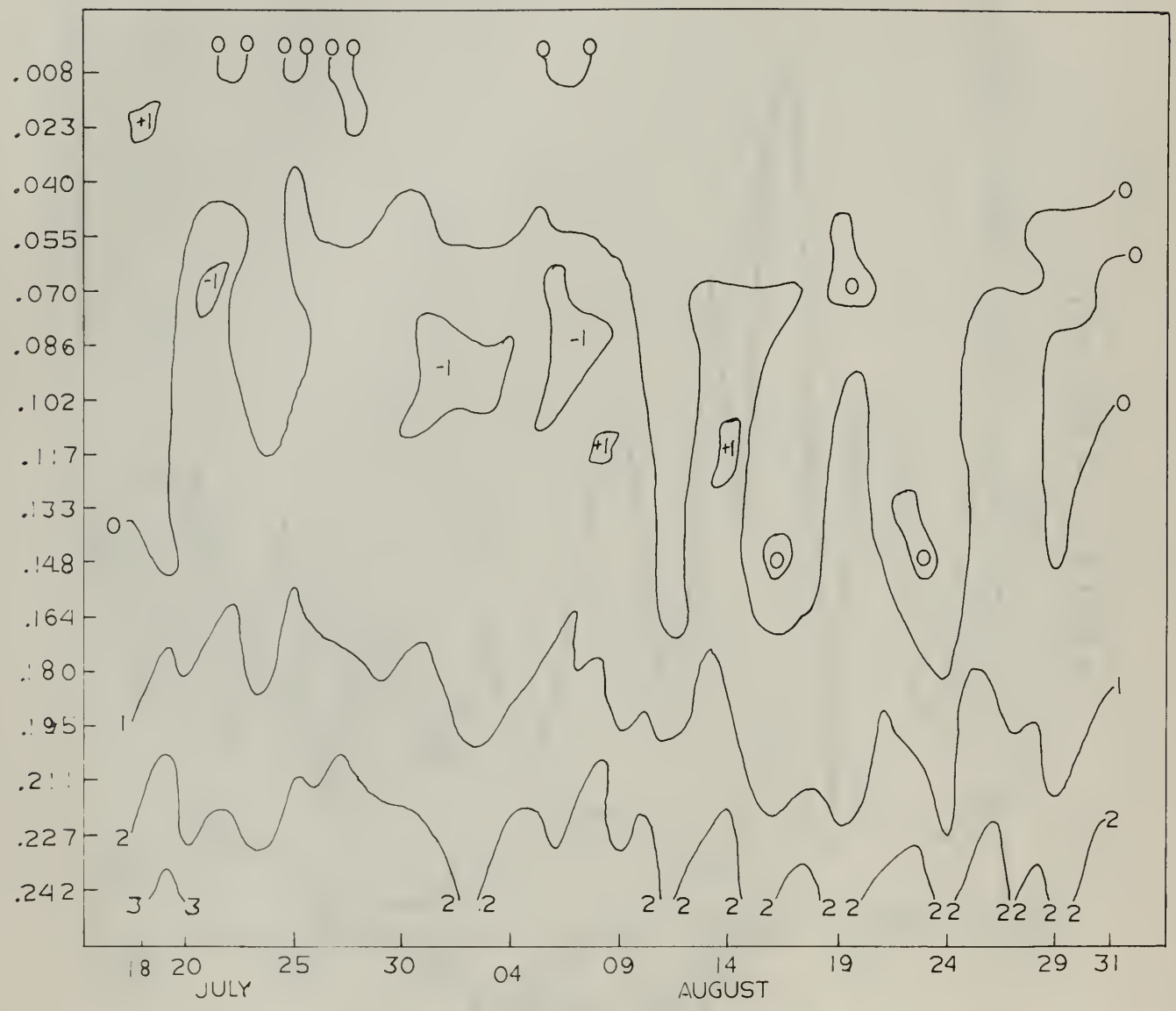


FIGURE 8. FREQUENCY (CPS) VS, TIME (DAYS) WITH CONTOURS OF EQUAL POWER DENSITY NUMBERS ON CONTOURS ARE CHARACTERISTICS OF $LN_{10}\ \bar{S}(f_i)$.

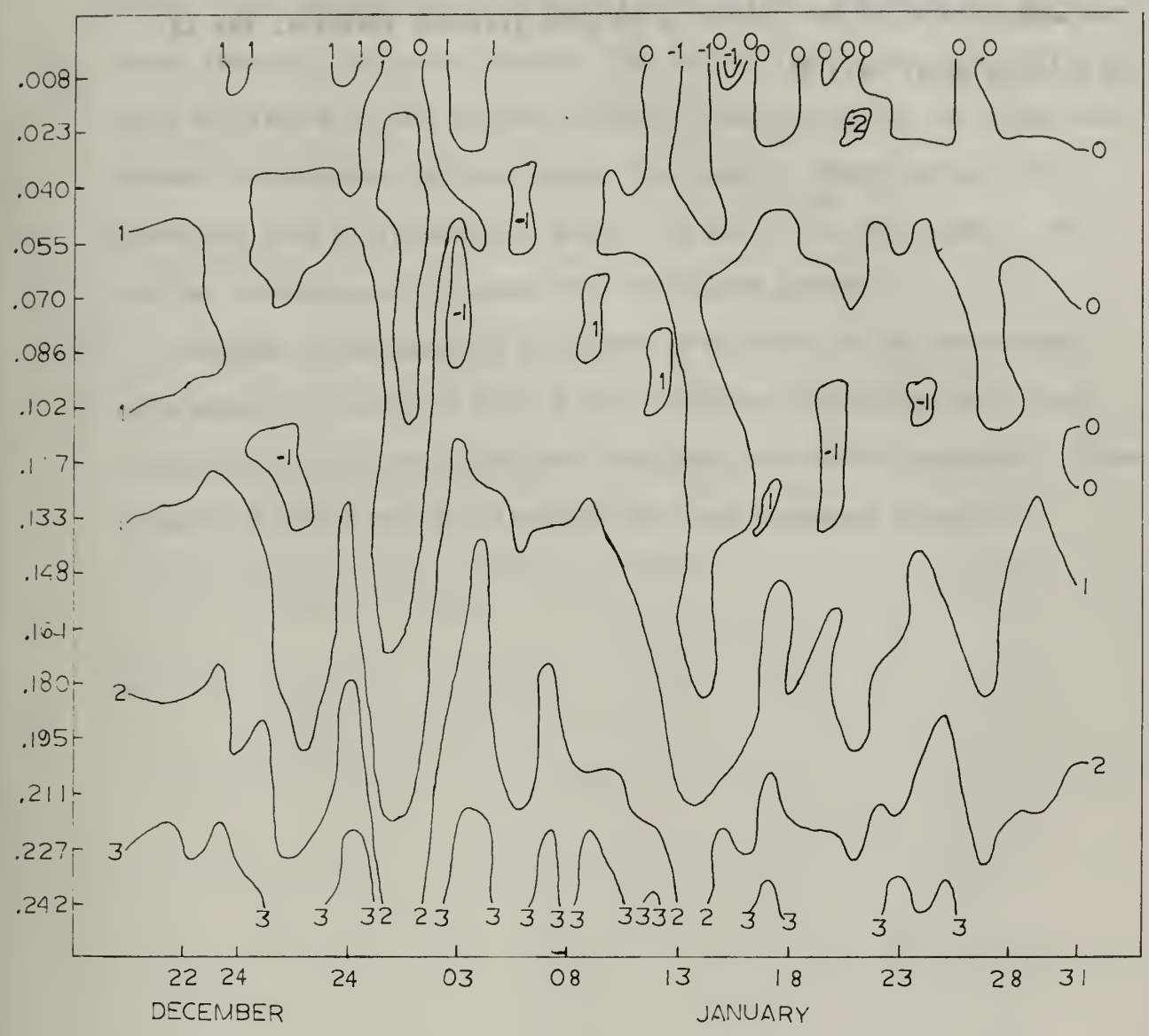


FIGURE 9. FREQUENCY (CPS) VS. TIME (DAYS) WITH CONTOURS OF EQUAL POWER DENSITY NUMBERS ON CONTOURS ARE CHARACTERISTICS OF $LN_{10}\ \bar{S}(f_1)$.

detail upon which Munk's hypothesis was based occurred between 0.40 and 0.80 sec.$^{-1}$ and therefore is beyond the range of this analysis. The ambiguity might be cleared up by more frequent analyses, say 12 or 6 hours apart vice 24.

VII. Conclusions and Recommendations

Intensity peaks in the summer and the winter occur about a week apart. The surface values of significant height in winter are about twice those of the summer period. The bottom ratios are much smaller. This difference is due to the different distribution of the energy with respect to frequency between winter and summer. There seems to be a preferred band of frequencies about 0.08 $sec.^{-1}$ for the winter. No similar characteristic appears for the summer months.

Further investigations to determine distance to the generating area should be conducted with a more sensitive digitizing instrument located at a shallower depth with analyses more often than daily. These procedures would tend to eliminate the high frequency noise.

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APPENDIX I

TABULAR DISPLAY OF SPECTRAL COMPONENTS FOR SELECTED INTERVALS

PT. SUR C813 TO 0836 1 JAN., 1948

BAND NO.	FREQUENCY (CPS)	AVG 16 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0078125	0.0027042	0.0027042	0.1730710	0.1739395	128.0000000
2	0.0234375	0.0010795	0.0037837	0.0690870	0.0723633	42.6666565
3	0.0390625	0.0010036	0.0047874	0.0642328	0.0731763	25.5999908
4	0.0546875	0.0004804	0.0052678	0.0307472	0.0398857	18.2857056
5	0.0703125	0.0002800	0.0055478	0.0179212	0.0279041	14.2222214
6	0.0859375	0.0005098	0.0060576	0.0326303	0.0647116	11.6363630
7	0.1015625	0.0001932	0.0062508	0.0123629	0.0335540	9.8461533
8	0.1171875	0.0005236	0.0067744	0.0335117	0.1356701	8.5333328
9	0.1328125	0.0004927	0.0072671	0.0315335	0.2090326	7.5294113
10	0.1484375	0.0006166	0.0078838	0.0394647	0.4811303	6.7368412
11	0.1640625	0.0008531	0.0087369	0.0546012	1.3705072	6.0952377
12	0.1796875	0.0004138	0.0091507	0.0264804	1.5620775	5.5652170
13	0.1953125	0.0002130	0.0093636	0.0136298	2.0550032	5.1199999
14	0.2109375	0.0000496	0.0094132	0.0031722	1.3508282	4.7407398
15	0.2265625	0.0000438	0.0094570	0.0028045	3.9547377	4.4137926
16	0.2421875	0.0000009	0.0094579	0.0000569	0.2620634	4.1290321
17	0.2578125	0.0	0.0094579	0.0	0.0	3.8787870
18	0.2734375	0.0000167	0.0094746	0.0010701	76.5008545	3.6571426
19	0.2890625	0.0000184	0.0094930	0.0011771	222.5232391	3.4594593
20	0.3046875	0.0001720	0.0096651	0.0110110	6515.3945312	3.2820511

PT. SUR 0818 TO 0836 1 JAN., 1948

BAND NO.	FREQUENCY (CPS)	AVG IG VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0048828	0.0019914	0.0019914	0.2039180	0.2043265	204.7999878
2	0.0146484	0.0008252	0.0028166	0.0844985	0.0860229	68.2666626
3	0.0244141	0.0007889	0.0036055	0.0807833	0.0849268	40.9599915
4	0.0341797	0.0009345	0.0045400	0.0956932	0.1056528	29.2571411
5	0.0439453	0.0002474	0.0047874	0.0253325	0.0298972	22.7555542
6	0.0537109	0.0003268	0.0051142	0.0334668	0.0430110	18.6181793
7	0.0634766	0.0002634	0.0053776	0.0269731	0.0385109	15.7538452
8	0.0732422	0.0001702	0.0055478	0.0174295	0.0282627	13.6533327
9	0.0830078	0.0003563	0.0059041	0.0364876	0.0688277	12.0470581
10	0.0927734	0.0002054	0.0061095	0.0210312	0.0474434	10.7789469
11	0.1025391	0.0000418	0.0061513	0.0042826	0.0118961	9.7523804
12	0.1123047	0.0002544	0.0064057	0.0260476	0.0921372	8.9043474
13	0.1220703	0.0003687	0.0067744	0.0377589	0.1763684	8.1919994
14	0.1318359	0.0002792	0.0070536	0.0285926	0.1836284	7.5851851
15	0.1416016	0.0006674	0.0077211	0.0683464	0.6291310	7.0620689
16	0.1513672	0.0001627	0.0078838	0.0166581	0.2308950	6.6064510
17	0.1611328	0.0004511	0.0083348	0.0461877	1.0029202	6.2060604
18	0.1708984	0.0005625	0.0088973	0.0576009	2.0678377	5.8514280
19	0.1806641	0.0002533	0.0091507	0.0259420	1.6340408	5.5351343
20	0.1904297	0.0000456	0.0091963	0.0046737	0.5173165	5.2512817
21	0.2001953	0.0001788	0.0093751	0.0183042	3.8952637	4.9951210
22	0.2099609	0.0000375	0.0094125	0.0038375	1.5331707	4.7627907
23	0.2197266	0.0000428	0.0094553	0.0043806	3.4897537	4.5511103
24	0.2294922	0.0000017	0.0094570	0.0001743	0.2926033	4.3574467
25	0.2392578	0.0000009	0.0094579	0.0000910	0.3357935	4.1795912
26	0.2490234	0.0	0.0094579	0.0	0.0	4.0156860
27	0.2587891	0.0	0.0094579	0.0	0.0	3.8641500
28	0.2685547	0.0	0.0094579	0.0	0.0	3.7236357
29	0.2783203	0.0000167	0.0094746	0.0017121	148.1056519	3.5929823
30	0.2880859	0.0000184	0.0094930	0.0018834	372.0368652	3.4711857
31	0.2978516	0.0000893	0.0095823	0.0091460	3806.8884277	3.3573761
32	0.3076172	0.0000827	0.0096650	0.0084716	6084.1601562	3.2507935

PT. SUR 1423 TO 1445 3 JAN., 1948

BAND NO.	FREQUENCY (CPS)	AVG 16 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0078125	0.5193050	0.5193050	33.2355194	33.4023132	128.0000000
2	0.0234375	0.1240414	0.6433464	7.9386482	8.3151197	42.6666565
3	0.0390625	0.0619786	0.7053249	3.9666281	4.5189228	25.5999908
4	0.0546875	0.1562447	0.8615696	9.9996605	12.9716797	18.2857056
5	0.0703125	0.0715650	0.9331346	4.5801620	7.1315203	14.2222214
6	0.0859375	0.0602976	0.9934322	3.8590488	7.6531677	11.6363630
7	0.1015625	0.0233451	1.0167770	1.4940863	4.0550690	9.8461533
8	0.1171875	0.0270736	1.0438499	1.7327099	7.0147638	8.5333328
9	0.1328125	0.0745794	1.1184292	4.7730827	31.6402893	7.5294113
10	0.1484375	0.0665329	1.1849613	4.2581062	51.9123230	6.7368412
11	0.1640625	0.0292435	1.2142048	1.8715839	46.9773102	6.0952377
12	0.1796875	0.0340050	1.2482090	2.1763210	128.3810577	5.5652170
13	0.1953125	0.0125083	1.2607164	0.8005292	120.6984406	5.1199999
14	0.2109375	0.0130768	1.2737923	0.8369131	356.3801270	4.7407398
15	0.2265625	0.0025082	1.2763004	0.1605227	226.3570862	4.4137926
16	0.2421875	0.0002190	1.2765198	0.0140172	64.6036224	4.1290321
17	0.2578125	0.0005403	1.2770586	0.0345794	569.8264160	3.8787970
18	0.2734375	0.0000859	1.2771444	0.0054996	393.1760254	3.6571426
19	0.2890625	0.0080214	1.2851658	0.5133722	97045.7500000	3.4594593
20	0.3046875	0.0039659	1.2891312	0.2538180	150188.1250000	3.2820511

PT. SUR 1429 TO 1446 3 JAN., 1948

BAND NO.	FREQUENCY (CPS)	AVG 10 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0048828	0.4002728	0.4002728	40.9879303	41.0700226	204.7999878
2	0.0146484	0.1389446	0.5392174	14.2279234	14.4846020	68.2666626
3	0.0244141	0.0849418	0.6241592	8.6980400	9.1441832	40.9599915
4	0.0341797	0.0484731	0.6726323	4.9636488	5.4802561	29.2571411
5	0.0439453	0.0393525	0.7119849	4.0296993	4.7558155	22.7555542
6	0.0537109	0.1025807	0.8145655	10.5042601	13.4998770	18.6181793
7	0.0634766	0.0532923	0.8678579	5.4571362	7.7914381	15.7538452
8	0.0732422	0.0652771	0.9331350	6.6843748	10.8390093	13.6533327
9	0.0830078	0.0494038	0.9825387	5.0589457	9.5428467	12.0470581
10	0.0927734	0.0191688	1.0017071	1.9628887	4.4280043	10.7789469
11	0.1025391	0.0104405	1.0121469	1.0691051	2.9697361	9.7523804
12	0.1123047	0.0310095	1.0431557	3.1753702	11.2321014	8.9043474
13	0.1220703	0.0009750	1.0441303	0.0998361	0.4663246	8.1919994
14	0.1318359	0.0570628	1.1011925	5.8432274	37.5265350	7.5851851
15	0.1416016	0.0416278	1.1428194	4.2626905	39.2382202	7.0620689
16	0.1513672	0.0421406	1.1849594	4.3151989	59.8120575	6.6064510
17	0.1611328	0.0185726	1.2035313	1.9018364	41.2965393	6.2060604
18	0.1708984	0.0355673	1.2390985	3.6420927	130.7489777	5.8514280
19	0.1806641	0.0091086	1.2482071	0.9327213	58.7503967	5.5351343
20	0.1904297	0.0085534	1.2567596	0.8758678	96.9469910	5.2512817
21	0.2001953	0.0039549	1.2607136	0.4049785	86.1820831	4.9951210
22	0.2099609	0.0083158	1.2690287	0.8515422	340.2084961	4.7627907
23	0.2197266	0.0049126	1.2739410	0.5030513	400.7465820	4.5511103
24	0.2294922	0.0023565	1.2762966	0.2413033	404.9743652	4.3574467
25	0.2392578	0.0	1.2762966	0.0	0.0	4.1795912
26	0.2490234	0.0007593	1.2770557	0.0777546	653.2458496	4.0156860
27	0.2587891	0.0	1.2770557	0.0	0.0	3.8641500
28	0.2685547	0.0000859	1.2771416	0.0087993	444.3549805	3.7236357
29	0.2783203	0.0014848	1.2786255	0.1520440	13152.5937500	3.5929823
30	0.2880859	0.0065366	1.2851620	0.6693516	132217.5625000	3.4711857
31	0.2978516	0.0001633	1.2853251	0.0167258	6961.8476562	3.3573761
32	0.3076172	0.0038026	1.2891273	0.3893831	279648.8125000	3.2507935

PT. SUR 1043 TO 1101 14 JAN., 1948

BAND NO.	FREQUENCY (CPS)	AVG 16 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0078125	0.0010234	0.0010234	0.0654995	0.0658282	128.0000000
2	0.0234375	0.0003676	0.0013910	0.0235270	0.0246428	42.6666565
3	0.0390625	0.0002848	0.0016759	0.0182296	0.0207679	25.5999908
4	0.0546875	0.0043043	0.0059802	0.2754784	0.3573538	18.2857056
5	0.0703125	0.0314910	0.0374712	2.0154247	3.1381073	14.2222214
6	0.0859375	0.0020647	0.0395359	0.1321413	0.2620592	11.6363630
7	0.1015625	0.0023534	0.0418893	0.1506179	0.4087890	9.8461533
8	0.1171875	0.0008524	0.0427417	0.0545522	0.2208511	8.5333328
9	0.1328125	0.0003582	0.0430999	0.0229238	0.1519592	7.5294113
10	0.1484375	0.0001293	0.0432292	0.0082737	0.1008678	6.7368412
11	0.1640625	0.0000720	0.0433011	0.0046057	0.1156043	6.0952377
12	0.1796875	0.0000181	0.0433192	0.0011563	0.0682076	5.5652170
13	0.1953125	0.0000042	0.0433234	0.0002670	0.0402521	5.1199999
14	0.2109375	0.0	0.0433234	0.0	0.0	4.7407398
15	0.2265625	0.0000095	0.0433329	0.0006082	0.8576959	4.4137926
16	0.2421875	0.0000006	0.0433335	0.0000400	0.1844185	4.1290321
17	0.2578125	0.0000083	0.0433418	0.0005295	8.7251759	3.8787870
18	0.2734375	0.0	0.0433418	0.0	0.0	3.6571426
19	0.2890625	0.0	0.0433418	0.0	0.0	3.4594593
20	0.3046875	0.0000000	0.0433418	0.0000002	0.1394113	3.2820511

PT. SUR 1043 TO 1101 14 JAN., 1948

BAND NO.	FREQUENCY (CPS)	AVG 10 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0048828	0.0007509	0.0007509	0.0768925	0.0770465	204.7999878
2	0.0146484	0.0004036	0.0011546	0.0413335	0.0420792	68.2666626
3	0.0244141	0.0001773	0.0013319	0.0181580	0.0190893	40.9599915
4	0.0341797	0.0000980	0.0014298	0.0100326	0.0110767	29.2571411
5	0.0439453	0.0002909	0.0017208	0.0297903	0.0351582	22.7555542
6	0.0537109	0.0023993	0.0041200	0.2456845	0.3157490	18.6181793
7	0.0634766	0.0164785	0.0205985	1.6873960	2.4091835	15.7538452
8	0.0732422	0.0168727	0.0374712	1.7277660	2.8016481	13.6533327
9	0.0830078	0.0017173	0.0391885	0.1758525	0.3317160	12.0470581
10	0.0927734	0.0010026	0.0401911	0.1026653	0.2315987	10.7789469
11	0.1025391	0.0014360	0.0416271	0.1470473	0.4084647	9.7523804
12	0.1123047	0.0007408	0.0423679	0.0758530	0.2683117	8.9043474
13	0.1220703	0.0003738	0.0427417	0.0382803	0.1788037	8.1919994
14	0.1318359	0.0003014	0.0430431	0.0308645	0.1982190	7.5851851
15	0.1416016	0.0000991	0.0431423	0.0101509	0.0934398	7.0620689
16	0.1513672	0.0000869	0.0432292	0.0089004	0.1233671	6.6064510
17	0.1611328	0.0000720	0.0433011	0.0073691	0.1600131	6.2060604
18	0.1708984	0.0	0.0433011	0.0	0.0	5.8514280
19	0.1806641	0.0000181	0.0433192	0.0018500	0.1165289	5.5351343
20	0.1904297	0.0000005	0.0433196	0.0000468	0.0051805	5.2512817
21	0.2001953	0.0000037	0.0433234	0.0003804	0.0809410	4.9951210
22	0.2099609	0.0	0.0433234	0.0	0.0	4.7627907
23	0.2197266	0.0	0.0433234	0.0	0.0	4.5511103
24	0.2294922	0.0000095	0.0433329	0.0009732	1.6332769	4.3574467
25	0.2392578	0.0	0.0433329	0.0	0.0	4.1795912
26	0.2490234	0.0000089	0.0433418	0.0009112	7.6552439	4.0156860
27	0.2587891	0.0	0.0433418	0.0	0.0	3.8641500
28	0.2685547	0.0	0.0433418	0.0	0.0	3.7236357
29	0.2783203	0.0	0.0433418	0.0	0.0	3.5929823
30	0.2880859	0.0	0.0433418	0.0	0.0	3.4711857
31	0.2978516	0.0000000	0.0433418	0.0000004	0.1569067	3.3573761
32	0.3076172	0.0	0.0433418	0.0	0.0	3.2507935

PT. SUR 0510 TO 0528 24 JAN., 1948

BAND NO.	FREQUENCY (CPS)	AVG	16 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0078125		0.1047357	0.1047357	6.7030869	6.7367277	128.0000000
2	0.0234375		0.0272029	0.1319386	1.7409878	1.8235493	42.6666565
3	0.0390625		0.0084577	0.1403963	0.5412920	0.6166590	25.5999908
4	0.0546875		0.0098836	0.1502799	0.6325526	0.8205549	18.2857056
5	0.0703125		0.0263215	0.1766014	1.6845751	2.6229601	14.2222214
6	0.0859375		0.0119161	0.1885175	0.7625328	1.5124340	11.6363630
7	0.1015625		0.0026555	0.1911729	0.1699489	0.4612548	9.8461533
8	0.1171875		0.0024876	0.1936605	0.1592081	0.6445435	8.5333328
9	0.1328125		0.0143658	0.2080262	0.9194102	6.0946789	7.5294113
10	0.1484375		0.0330536	0.2410798	2.1154299	25.7900696	6.7368412
11	0.1640625		0.0101955	0.2512753	0.6525130	16.3782654	6.0952377
12	0.1796875		0.0068258	0.2581010	0.4368482	25.7696381	5.5652170
13	0.1953125		0.0064828	0.2645838	0.4148970	62.5553741	5.1199999
14	0.2109375		0.0017704	0.2663541	0.1133025	48.2472382	4.7407398
15	0.2265625		0.0018109	0.2681649	0.1158972	163.4296112	4.4137926
16	0.2421875		0.0001583	0.2683232	0.0101290	46.6834564	4.1290321
17	0.2578125		0.0	0.2683232	0.0	0.0	3.8787870
18	0.2734375		0.0010967	0.2694198	0.0701864	5017.7539062	3.6571426
19	0.2890625		0.0011226	0.2705424	0.0718465	13581.5625000	3.4594593
20	0.3046875		0.0061704	0.2767128	0.3949051	233671.6250000	3.2820511

PT. SUR C513 TO 0528 24 JAN., 1948

BAND NO.	FREQUENCY (CPS)	AVG 10 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0048828	0.0662065	0.0662065	6.7795410	6.7931204	204.7999878
2	0.0146484	0.0424781	0.1086845	4.3497524	4.4282236	68.2666626
3	0.0244141	0.0214037	0.1300882	2.1917429	2.3041620	40.9599915
4	0.0341797	0.0068612	0.1369494	0.7025917	0.7757161	29.2571411
5	0.0439453	0.0038322	0.1407816	0.3924170	0.4631271	22.7555542
6	0.0537109	0.0043297	0.1451112	0.4433586	0.5697961	18.6181793
7	0.0634766	0.0156667	0.1607779	1.6042662	2.2904940	15.7538452
8	0.0732422	0.0158234	0.1766012	1.6203156	2.6274128	13.6533327
9	0.0830078	0.0068463	0.1834475	0.7010627	1.3224363	12.0470581
10	0.0927734	0.0059833	0.1894308	0.6126926	1.3821487	10.7789469
11	0.1025391	0.0013507	0.1907815	0.1383080	0.3841890	9.7523804
12	0.1123047	0.0010124	0.1917939	0.1036683	0.3667014	8.9043474
13	0.1220703	0.0027892	0.1945831	0.2856147	1.3340788	8.1919994
14	0.1318359	0.0109423	0.2055253	1.1204882	7.1960316	7.5851851
15	0.1416016	0.0208211	0.2263464	2.1320839	19.6259003	7.0620689
16	0.1513672	0.0147333	0.2410797	1.5086918	20.9116516	6.6064510
17	0.1611328	0.0064612	0.2475408	0.6616253	14.3665552	6.2060604
18	0.1708984	0.0059098	0.2534506	0.6051620	21.7249603	5.8514280
19	0.1806641	0.0044258	0.2578763	0.4532039	28.5464783	5.5351343
20	0.1904297	0.0023846	0.2602609	0.2441821	27.0277252	5.2512817
21	0.2001953	0.0044044	0.2646652	0.4510078	95.9774323	4.9951210
22	0.2099609	0.0008738	0.2655391	0.0894819	35.7498627	4.7627907
23	0.2197266	0.0015056	0.2670446	0.1541741	122.8199921	4.5511103
24	0.2294922	0.0011201	0.2681646	0.1146953	192.4907532	4.3574467
25	0.2392578	0.0000316	0.2681962	0.0032397	11.9577408	4.1795912
26	0.2490234	0.0001266	0.2683228	0.0129667	108.9384460	4.0156860
27	0.2587891	0.0	0.2683228	0.0	0.0	3.8641500
28	0.2685547	0.0005099	0.2688327	0.0522116	2636.6162109	3.7236357
29	0.2783203	0.0007648	0.2695974	0.0783124	6774.4257812	3.5929823
30	0.2880859	0.0004460	0.2700434	0.0456686	9020.9570312	3.4711857
31	0.2978516	0.0036720	0.2737153	0.3760087	156507.2500000	3.3573761
32	0.3076172	0.0029971	0.2767124	0.3069001	220410.8125000	3.2507935

PT. SHP 1105 TO 1123 27 JAN., 1968

BAND NO.	FREQUENCY (CPS)	AVG. IA VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0078125	0.1133496	0.1133496	7.2543716	7.2307701	128.0000000
2	0.0234375	0.0315850	0.1449345	2.0214376	2.1172001	42.6666665
3	0.0390625	0.0057040	0.1507384	0.3708754	0.4225144	25.5999999
4	0.0546875	0.0014973	0.1522356	0.0958260	0.1243078	18.2857056
5	0.0703125	0.0284147	0.1806412	1.8185277	2.0215459	14.2222216
6	0.0859375	0.0338682	0.2145095	2.1675711	4.2086717	11.6363630
7	0.1015625	0.0135952	0.2281047	0.8700374	2.3615131	9.8461532
8	0.1171875	0.0017723	0.2298770	0.1134382	0.4502066	8.5333328
9	0.1328125	0.0039734	0.2338504	0.2542382	1.6857174	7.5294112
10	0.1484375	0.0222503	0.2561006	1.4240170	17.2607708	6.7368412
11	0.1640625	0.0047828	0.2608834	0.3061022	7.6833502	6.0952377
12	0.1796875	0.0011070	0.2619903	0.0708454	4.1701677	5.5652170
13	0.1953125	0.0012228	0.2632130	0.0782573	11.7001152	5.1199999
14	0.2109375	0.0005081	0.2637211	0.0325200	13.8478851	4.7407398
15	0.2265625	0.0	0.2637211	0.0	0.0	4.4137926
16	0.2421875	0.0	0.2637211	0.0	0.0	4.1290321
17	0.2578125	0.0003054	0.2640265	0.0195459	372.0222852	3.8787870
18	0.2734375	0.0	0.2640265	0.0	0.0	3.6571426
19	0.2890625	0.0002813	0.2643077	0.0180051	3473.6110840	3.4504533
20	0.3046875	0.0003820	0.2646897	0.0244439	14447.4101562	3.2823511

PT. SUR 1105 TO 1123 27 JAN., 1968

BAND NO.	FREQUENCY (CPS)	AVG 10 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0048828	0.0799524	0.0799524	8.1871271	8.2035255	204.7399878
2	0.0146484	0.0496957	0.1296481	5.0888305	5.1806640	68.2666626
3	0.0244141	0.0139299	0.1435779	1.4264212	1.4905852	40.9599915
4	0.0341797	0.0062908	0.1498687	0.6441829	0.7112282	29.2571411
5	0.0439453	0.0008606	0.1507292	0.0881203	0.1039988	22.7555542
6	0.0537109	0.0011026	0.1518319	0.1129113	0.1451114	18.6181703
7	0.0634766	0.0052618	0.1570936	0.5388073	0.7602932	15.7538452
8	0.0732422	0.0235475	0.1806411	2.4112435	3.0099702	13.6533327
9	0.0830078	0.0306483	0.2112893	3.1383820	5.0200268	12.0470581
10	0.0927734	0.0067993	0.2180886	0.6962450	1.5706330	10.7780460
11	0.1025391	0.0082597	0.2263482	0.8457035	2.3494262	9.7523804
12	0.1123047	0.0029964	0.2293445	0.3068347	1.0853520	8.9363474
13	0.1220703	0.0005322	0.2298768	0.0545017	0.2545722	8.1919904
14	0.1318359	0.0036273	0.2335041	0.3714344	2.3854361	7.5851851
15	0.1416016	0.0027804	0.2362844	0.2847099	2.6207657	7.0620689
16	0.1513672	0.0198160	0.2561004	2.0291624	28.1257935	6.6064510
17	0.1611328	0.0041277	0.2602281	0.4226772	9.1780281	6.2050604
18	0.1708984	0.0006551	0.2608832	0.0670863	2.4083576	5.8514290
19	0.1806641	0.0011070	0.2619901	0.1133527	7.1398745	5.5351343
20	0.1904297	0.0002647	0.2622548	0.0271010	2.9997206	5.2512817
21	0.2001953	0.0009581	0.2632129	0.0981108	29.8786163	4.9951210
22	0.2099609	0.0005081	0.2637209	0.0520320	29.7879265	4.7627907
23	0.2197266	0.0	0.2637209	0.0	0.0	4.5511103
24	0.2294922	0.0	0.2637209	0.0	0.0	4.3574667
25	0.2392578	0.0	0.2637209	0.0	0.0	4.1795912
26	0.2490234	0.0003054	0.2640263	0.0312734	252.7305020	4.0156860
27	0.2587891	0.0	0.2640263	0.0	0.0	3.8641500
28	0.2685547	0.0	0.2640263	0.0	0.0	3.7236357
29	0.2783203	0.0	0.2640263	0.0	0.0	3.5929823
30	0.2880859	0.0002813	0.2643076	0.0288082	5690.5000000	3.4711857
31	0.2978516	0.0003725	0.2646801	0.0381479	15878.4375000	3.3573761
32	0.3076172	0.0000095	0.2646896	0.0000719	608.0227051	3.2507935

PT. SUR 1046 TO 1104 30 JAN., 1969

BAND NO.	FREQUENCY (CPS)	AVG 16 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0078125	0.1049982	0.1049982	6.7199880	6.7536087	128.0000000
2	0.0234375	0.0288128	0.1338109	1.8440170	1.9314651	42.6666565
3	0.0390625	0.0045326	0.1383435	0.2900879	0.3304784	25.5999908
4	0.0546875	0.0008389	0.1391824	0.0536927	0.0696508	18.2857056
5	0.0703125	0.0305974	0.1697798	1.9582319	3.0490561	14.2222214
6	0.0859375	0.0072393	0.1770191	0.4633160	0.9188365	11.6363630
7	0.1015625	0.0058600	0.1828790	0.3750386	1.0178843	9.8461533
8	0.1171875	0.0026333	0.1855123	0.1685321	0.6822912	8.5333328
9	0.1328125	0.0019739	0.1874862	0.1263314	0.8374383	7.5294113
10	0.1484375	0.0318520	0.2193382	2.0385303	24.8525543	6.7368412
11	0.1640625	0.0061819	0.2255201	0.3956413	9.9307156	6.0952377
12	0.1796875	0.0054791	0.2309992	0.3506629	20.6855774	5.5652170
13	0.1953125	0.0006138	0.2316130	0.0392863	5.9233322	5.1199999
14	0.2109375	0.0008305	0.2324435	0.0531496	22.6325073	4.7407398
15	0.2265625	0.0001716	0.2326151	0.0109853	15.4906530	4.4137926
16	0.2421875	0.0005221	0.2331371	0.0334156	154.0081635	4.1290321
17	0.2578125	0.0002336	0.2333707	0.0149499	246.3566589	3.8787870
18	0.2734375	0.0000321	0.2334028	0.0020526	146.7417603	3.6571426
19	0.2890625	0.0004049	0.2338076	0.0259124	4898.3632812	3.4594593
20	0.3046875	0.0001671	0.2339746	0.0106923	6326.8125000	3.2820511

BAND NO.	FREQUENCY (CPS)	AVG 10 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0048823	0.0929366	0.0929366	9.5167112	9.5357723	204.7999878
2	0.0146484	0.0218320	0.1147686	2.2355957	2.2759266	68.2666626
3	0.0244141	0.0186661	0.1334347	1.9114113	2.0094519	40.9599915
4	0.0341797	0.0026176	0.1360523	0.2680452	0.2959428	29.2571411
5	0.0439453	0.0024576	0.1385099	0.2516572	0.2970037	22.7555542
6	0.0537109	0.0006726	0.1391824	0.0688728	0.0885140	18.6181793
7	0.0634766	0.0016279	0.1408103	0.1666977	0.2380031	15.7539452
8	0.0732422	0.0289695	0.1697797	2.9664717	4.8102646	13.6533327
9	0.0830078	0.0042130	0.1739928	0.4314151	1.8137918	12.0470581
10	0.0927734	0.0055788	0.1795715	0.5712665	1.2886972	10.7789469
11	0.1025391	0.0033075	0.1828790	0.3386855	0.9407930	9.7523804
12	0.1123047	0.0020509	0.1849299	0.2100172	0.7428849	8.9043474
13	0.1220703	0.0005824	0.1855122	0.0596341	0.2785452	8.1919994
14	0.1318359	0.0012916	0.1868039	0.1322645	0.8494329	7.5851851
15	0.1416016	0.0090395	0.1958434	0.9256470	8.5206156	7.0620689
16	0.1513672	0.0234948	0.2193382	2.4058695	33.3472443	6.6064510
17	0.1611328	0.0048368	0.2241749	0.4952877	10.7546940	6.2060604
18	0.1708984	0.0024785	0.2266534	0.2537966	9.1111498	5.8514280
19	0.1806641	0.0039820	0.2306354	0.4077610	25.6841125	5.5351343
20	0.1904297	0.0004561	0.2310915	0.0467065	5.1697922	5.2512817
21	0.2001953	0.0005214	0.2316129	0.0533932	11.3624239	4.9951210
22	0.2099609	0.0007780	0.2323909	0.0796701	31.8298187	4.7627907
23	0.2197266	0.0002241	0.2326149	0.0229457	18.2792358	4.5511103
24	0.2294922	0.0	0.2326149	0.0	0.0	4.3574467
25	0.2392578	0.0000935	0.2327084	0.0095704	35.3240814	4.1795912
26	0.2490234	0.0004287	0.2331370	0.0438946	368.7746582	4.0156860
27	0.2587891	0.0002336	0.2333706	0.0239199	456.3330078	3.8641500
28	0.2685547	0.0	0.2333706	0.0	0.0	3.7236357
29	0.2783203	0.0000321	0.2334027	0.0032841	284.0920410	3.5929823
30	0.2880859	0.0004049	0.2338075	0.0414598	8189.5820312	3.4711357
31	0.2978516	0.0000312	0.2338387	0.0031980	1331.0986328	3.3573761
32	0.3076172	0.0001358	0.2339745	0.0139097	9989.7578125	3.2507935

PT. SUR 1242 TO 1300 1 AUG., 1949

BAND NO.	FREQUENCY (CPS)	AVG 16 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0078125	0.0101095	0.0101095	0.6470084	0.6502556	128.0000000
2	0.0234375	0.0042086	0.0143181	0.2693522	0.2821256	42.6666565
3	0.0390625	0.0040424	0.0183605	0.2587147	0.2947369	25.5999908
4	0.0546875	0.0085266	0.0268871	0.5456994	0.7078878	18.2857056
5	0.0703125	0.0474033	0.0742904	3.0338135	4.7237854	14.2222214
6	0.0859375	0.0054665	0.0797569	0.3498564	0.6938263	11.6363630
7	0.1015625	0.0009198	0.0806767	0.0588686	0.1597740	9.8461533
8	0.1171875	0.0029356	0.0836123	0.1878814	0.7606255	8.5333328
9	0.1328125	0.0038516	0.0874638	0.2465000	1.6340237	7.5294113
10	0.1484375	0.0037624	0.0912262	0.2407942	2.9356213	6.7368412
11	0.1640625	0.0011014	0.0923275	0.0704870	1.7692451	6.0952377
12	0.1796875	0.0012466	0.0935740	0.0797834	4.7064171	5.5652170
13	0.1953125	0.0007244	0.0942984	0.0463611	6.9900169	5.1199999
14	0.2109375	0.0004083	0.0947067	0.0261316	11.1275339	4.7407398
15	0.2265625	0.0002919	0.0949986	0.0186835	26.3460846	4.4137926
16	0.2421875	0.0000668	0.0950653	0.0042722	19.6898346	4.1290321
17	0.2578125	0.0000120	0.0950773	0.0007673	12.6436949	3.8787870
18	0.2734375	0.0001600	0.0952373	0.0102411	732.1577148	3.6571426
19	0.2890625	0.0002187	0.0954559	0.0139970	2645.9404297	3.4594593
20	0.3046875	0.0003752	0.0958312	0.0240137	14209.2617187	3.2820511

PT. SUR 1242 TO 1[illegible] 1 AUG., 1949

BAND NO.	FREQUENCY (CPS)	AVG 10 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0048828	0.0073523	0.0073523	0.7528785	0.7543865	204.7999878
2	0.0146484	0.0034824	0.0108348	0.3566003	0.3630335	68.2666626
3	0.0244141	0.0030890	0.0139237	0.3163097	0.3325340	40.9599915
4	0.0341797	0.0033534	0.0172771	0.3433886	0.3791278	29.2571411
5	0.0439453	0.0013591	0.0186362	0.1391740	0.1642519	22.7555542
6	0.0537109	0.0052577	0.0238940	0.5383922	0.6919315	18.6181793
7	0.0634765	0.0266944	0.0505883	2.7335033	3.9027653	15.7538452
8	0.0732422	0.0237021	0.0742905	2.4270964	3.9356441	13.6533327
9	0.0830078	0.0034224	0.0777128	0.3504537	0.6610718	12.0470581
10	0.0927734	0.0021378	0.0798506	0.2189069	0.4938235	10.7789469
11	0.1025391	0.0004088	0.0802593	0.0418630	0.1162860	9.7523804
12	0.1123047	0.0015926	0.0818519	0.1630804	0.5768573	8.9043474
13	0.1220703	0.0022651	0.0841169	0.2319422	1.0833797	8.1919994
14	0.1318359	0.0024635	0.0865804	0.2522629	1.6200905	7.5851851
15	0.1416016	0.0034606	0.0900410	0.3543661	3.2619524	7.0620689
16	0.1513672	0.0011852	0.0912262	0.1213658	1.6822252	6.6064510
17	0.1611328	0.0009318	0.0921579	0.0954130	2.0718002	6.2060604
18	0.1708984	0.0007071	0.0928650	0.0724113	2.5995226	5.8514280
19	0.1806641	0.0006499	0.0935149	0.0665529	4.1920462	5.5351343
20	0.1904297	0.0004697	0.0939846	0.0480998	5.3240118	5.2512817
21	0.2001953	0.0003138	0.0942984	0.0321337	6.8382568	4.9951210
22	0.2099609	0.0002932	0.0945916	0.0300237	11.9950790	4.7627907
23	0.2197266	0.0001151	0.0947067	0.0117868	9.3897638	4.5511103
24	0.2294922	0.0002919	0.0949985	0.0298936	50.1698456	4.3574467
25	0.2392578	0.0000668	0.0950652	0.0068355	25.2294617	4.1795912
26	0.2490234	0.0	0.0950652	0.0	0.0	4.0156860
27	0.2587891	0.0000120	0.0950772	0.0012276	23.4202576	3.8641500
28	0.2685547	0.0001102	0.0951874	0.0112804	569.6447754	3.7236357
29	0.2783203	0.0000499	0.0952372	0.0051054	441.6450195	3.5929823
30	0.2880859	0.0001667	0.0954039	0.0170677	3371.3901367	3.4711857
31	0.2978516	0.0002131	0.0956169	0.0218240	9083.8867187	3.3573761
32	0.3076172	0.0002141	0.0958310	0.0219254	15746.4570312	3.2507935

FT. SUR 1504 TO 1522 6 AUG., 1949

BAND NO.	FREQUENCY (CPS)	AVG 16 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0078125	0.0344237	0.0344237	2.2031193	2.2141762	128.0000000
2	0.0234375	0.0046090	0.0390328	0.2949772	0.3089657	42.6666565
3	0.0390625	0.0009958	0.0400286	0.0637319	0.0726056	25.5999908
4	0.0546875	0.0048500	0.0448785	0.3103971	0.4026509	18.2857056
5	0.0703125	0.0003128	0.0451914	0.0200215	0.0311743	14.2222214
6	0.0859375	0.0	0.0451914	0.0	0.0	11.6363630
7	0.1015625	0.0000179	0.0452093	0.0011474	0.0031142	9.8461533
8	0.1171875	0.0078951	0.0531044	0.5052843	2.0456104	8.5333328
9	0.1328125	0.0053358	0.0584402	0.3414936	2.2637272	7.5294113
10	0.1484375	0.0002112	0.0586514	0.0135148	0.1647888	6.7368412
11	0.1640625	0.0005470	0.0591984	0.0350109	0.8787838	6.0952377
12	0.1796875	0.0010731	0.0602715	0.0686765	4.0512209	5.5652170
13	0.1953125	0.0001868	0.0604583	0.0119530	1.8021927	5.1199999
14	0.2109375	0.0	0.0604583	0.0	0.0	4.7407398
15	0.2265625	0.0	0.0604583	0.0	0.0	4.4137926
16	0.2421875	0.0000060	0.0604643	0.0003837	1.7683630	4.1290321
17	0.2578125	0.0	0.0604643	0.0	0.0	3.8787870
18	0.2734375	0.0	0.0604643	0.0	0.0	3.6571426
19	0.2890625	0.0	0.0604643	0.0	0.0	3.4594593
20	0.3046875	0.0	0.0604643	0.0	0.0	3.2820511

PT. SUR 1954 T[illegible] 1922 5 AUG., 1940

BAND NO.	FREQUENCY (CPS)	AVG 1C VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0044828	0.0252552	0.0252552	2.5861340	2.5913134	204.7999878
2	0.0146484	0.0116718	0.0369270	1.1951923	1.2167540	68.2666626
3	0.0244141	0.0017584	0.0386854	0.1800550	0.1852905	40.9599915
4	0.0341797	0.0007298	0.0394141	0.0746263	0.0823932	29.2571411
5	0.0439453	0.0007059	0.0401201	0.0722365	0.0853118	22.7555542
6	0.0537109	0.0043587	0.0444788	0.4463317	0.5736171	18.6181793
7	0.0634766	0.0004300	0.0449088	0.0440348	0.0628707	15.7538452
8	0.0732422	0.0002826	0.0451914	0.0289339	0.0469273	13.6533327
9	0.0830078	0.0	0.0451914	0.0	0.0	12.0470581
10	0.0927734	0.0	0.0451914	0.0	0.0	10.7789469
11	0.1025391	0.0	0.0451914	0.0	0.0	9.7523804
12	0.1123047	0.0010885	0.0462799	0.1114597	0.3942617	8.9043474
13	0.1220703	0.0069901	0.0532700	0.7157832	3.3433552	8.1919994
14	0.1318359	0.0038575	0.0571275	0.3950030	2.5368319	7.5851851
15	0.1416016	0.0015240	0.0586514	0.1560566	1.4365063	7.0620689
16	0.1513672	0.0	0.0586514	0.0	0.0	6.6064510
17	0.1611328	0.0002607	0.0589122	0.0266963	0.5796839	6.2060604
18	0.1708984	0.0003411	0.0592533	0.0349317	1.2540255	5.8514280
19	0.1806641	0.0007788	0.0600321	0.0797492	5.0232525	5.5351343
20	0.1904297	0.0003695	0.0604016	0.0378349	4.1878233	5.2512817
21	0.2001953	0.0000568	0.0604583	0.0058126	1.2369604	4.9951210
22	0.2099609	0.0	0.0604583	0.0	0.0	4.7627907
23	0.2197266	0.0	0.0604583	0.0	0.0	4.5511103
24	0.2294922	0.0	0.0604583	0.0	0.0	4.3574467
25	0.2392578	0.0	0.0604583	0.0	0.0	4.1795912
26	0.2490234	0.0000060	0.0604643	0.0006139	5.1575966	4.0156860
27	0.2587891	0.0	0.0604643	0.0	0.0	3.8641500
28	0.2685547	0.0	0.0604643	0.0	0.0	3.7236357
29	0.2783203	0.0	0.0604643	0.0	0.0	3.5929823
30	0.2880859	0.0	0.0604643	0.0	0.0	3.4711857
31	0.2978516	0.0	0.0604643	0.0	0.0	3.3573761
32	0.3076172	0.0	0.0604643	0.0	0.0	3.2507935

PT. SUR 1505 TO 1523 7 AUG., 1949

BAND NO.	FREQUENCY (CPS)	AVG 16 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0078125	0.0147129	0.0147129	0.9416177	0.9463435	128.0000000
2	0.0234375	0.0028009	0.0175137	0.1792568	0.1877576	42.6666565
3	0.0390625	0.0077590	0.0252727	0.4965773	0.5657184	25.5999908
4	0.0546875	0.0216306	0.0469032	1.3843555	1.7958021	18.2857056
5	0.0703125	0.0298258	0.0767291	1.9088535	2.9721718	14.2222214
6	0.0859375	0.0042420	0.0809711	0.2714889	0.5384099	11.6363630
7	0.1015625	0.0240038	0.1049748	1.5362406	4.1694794	9.8461533
8	0.1171875	0.0318210	0.1367958	2.0365458	8.2448235	8.5333328
9	0.1328125	0.0026426	0.1394384	0.1691272	1.1211271	7.5294113
10	0.1484375	0.0023292	0.1417675	0.1490662	1.8173265	6.7368412
11	0.1640625	0.0023561	0.1441236	0.1507989	3.7848463	6.0952377
12	0.1796875	0.0003860	0.1445095	0.0247014	1.4571323	5.5652170
13	0.1953125	0.0001581	0.1446676	0.0101182	1.5255499	5.1199999
14	0.2109375	0.0004692	0.1451367	0.0300282	12.7868280	4.7407398
15	0.2265625	0.0014093	0.1465460	0.0901960	127.1876678	4.4137926
16	0.2421875	0.0004409	0.1469868	0.0282159	130.0436249	4.1290321
17	0.2578125	0.0000798	0.1470666	0.0051066	84.1511230	3.8787870
18	0.2734375	0.0007265	0.1477931	0.0464981	3324.2407227	3.6571426
19	0.2890625	0.0002123	0.1480054	0.0135851	2568.0686035	3.4594593
20	0.3046875	0.0000310	0.1480363	0.0019824	1173.0441895	3.2820511

PT. SUP 1505 TO 1523 7 AUG., 1969

BAND NO.	FREQUENCY (CPS)	AVG	IC VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	C.0043828		0.0072711	0.0072711	C.7445625	0.7460539	204.7999878
2	0.0146434		0.0085957	0.0158669	C.8802036	0.8826826	68.2666626
3	0.0244141		0.0011436	0.0170104	C.1171036	0.1231101	40.9599915
4	0.0341797		0.0034941	0.0205045	C.3577960	0.3950347	29.2571411
5	0.0439453		0.0048492	0.0253537	C.4965549	0.5860298	22.7555542
6	0.0537109		0.0152244	0.0405781	1.5589790	2.0035696	18.6181793
7	C.0634766		C.0280953	0.0686734	2.8769636	4.1075907	15.7538452
8	C.0732422		C.0080557	0.0767291	C.8248993	1.3376102	13.6533327
9	0.0830078		0.0021038	0.0788329	C.2154254	0.4063635	12.0470581
10	0.0927734		C.0038321	0.0826649	C.3924103	0.8852223	10.7789469
11	0.1025391		0.0190499	0.1017148	1.9507141	5.4186497	9.7523804
12	0.1123047		0.0231815	0.1248963	2.3737803	8.3966713	8.9043474
13	C.1220703		0.0118996	0.1367958	1.2185163	5.6915731	8.1919994
14	0.1318359		0.0024131	0.1392089	C.2470999	1.5869322	7.5851851
15	0.1416016		0.0009328	0.1401415	0.0955141	0.8792105	7.0620689
16	C.1513672		0.0016259	0.1417675	0.1664955	2.3077583	6.6064510
17	0.1611328		0.0008375	0.1426050	C.0857639	1.8622780	6.2060604
18	C.1708984		0.0015185	0.1441235	C.1554985	5.5823040	5.8514280
19	C.1806641		0.0003860	0.1445094	C.0395222	2.4894295	5.5351343
20	C.1904297		0.0001581	0.1446675	0.0161891	1.7919168	5.2512817
21	C.2001953		0.0002151	0.1448826	0.0220236	4.6867743	4.9951210
22	0.2099609		0.0002541	0.1451367	C.0260215	10.3961306	4.7627907
23	C.2197266		0.0014093	0.1465459	C.1443136	114.9647827	4.5511103
24	0.2294922		0.0	0.1465459	0.0	0.0	4.3574467
25	0.2392578		0.0004409	0.1469868	C.0451455	166.6306610	4.1795912
26	C.2490234		0.0	0.1469868	C.0	0.0	4.0156860
27	C.2587891		C.0000798	0.1470665	C.0081706	155.8754272	3.8641500
28	0.2685547		0.0	0.1470665	0.0	0.0	3.7236357
29	0.2783203		0.0008371	0.1479036	C.0857140	7414.7031250	3.5929823
30	0.2880859		0.0001017	0.1480053	0.0104191	2058.0996094	3.4711857
31	0.2978516		0.0000310	0.1480362	C.0031719	1320.2543945	3.3573761
32	C.3076172		0.0	0.1480362	C.0	0.0	3.2507935

PT. SUR 1541 TO 1559 17 AUG., 1949

BAND NO.	FREQUENCY (CPS)	AVG 16 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0078125	0.0003923	0.0003923	0.0251043	0.0252303	128.0000000
2	0.0234375	0.0011339	0.0015262	0.0725714	0.0760129	42.6666565
3	0.0390625	0.0003762	0.0019024	0.0240793	0.0274320	25.5999908
4	0.0546875	0.0114772	0.0133797	0.7345428	0.9528578	18.2857056
5	0.0703125	0.0132776	0.0266572	0.8497663	1.3231239	14.2222214
6	0.0859375	0.0054608	0.0321180	0.3494885	0.6930967	11.6363630
7	0.1015625	0.0047335	0.0368515	0.3029408	0.8222056	9.8461533
8	0.1171875	0.0023741	0.0392255	0.1519394	0.6151168	8.5333328
9	0.1328125	0.0010296	0.0402551	0.0658932	0.4367993	7.5294113
10	0.1484375	0.0005508	0.0408059	0.0352535	0.4297898	6.7368412
11	0.1640625	0.0000868	0.0408927	0.0055521	0.1393595	6.0952377
12	0.1796875	0.0000501	0.0409428	0.0032083	0.1892554	5.5652170
13	0.1953125	0.0000069	0.0409497	0.0004408	0.0664636	5.1199999
14	0.2109375	0.0000303	0.0409800	0.0019412	0.8265952	4.7407398
15	0.2265625	0.0001245	0.0411045	0.0079668	11.2342129	4.4137926
16	0.2421875	0.0000053	0.0411098	0.0003408	1.5708094	4.1290321
17	0.2578125	0.0	0.0411098	0.0	0.0	3.8787870
18	0.2734375	0.0000192	0.0411290	0.0012293	87.8867798	3.6571426
19	0.2890625	0.0	0.0411290	0.0	0.0	3.4594593
20	0.3046875	0.0	0.0411290	0.0	0.0	3.2820511

PT. SUR 1541 TO 1559 17 AUG., 1949

BAND NO.	FREQUENCY (CPS)	AVG. IC VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0048828	0.0003468	0.0003468	0.0355166	0.0355878	204.7999878
2	0.0146484	0.0006427	0.0009896	0.0658149	0.0670022	68.2666626
3	0.0244141	0.0005326	0.0015221	0.0545343	0.0573315	40.9599915
4	0.0341797	0.0001490	0.0016711	0.0152536	0.0168411	29.2571411
5	0.0439453	0.0002741	0.0019452	0.0280710	0.0331291	22.7555542
6	0.0537109	0.0104954	0.0124406	1.0747242	1.3812151	18.6181793
7	0.0634766	0.0034373	0.0158779	0.3519843	0.5025463	15.7538452
8	0.0732422	0.0107793	0.0266572	1.1038036	1.7898655	13.6533327
9	0.0830078	0.0040111	0.0306683	0.4107723	0.7747771	12.0470581
10	0.0927734	0.0025087	0.0331770	0.2568946	0.5795186	10.7789469
11	0.1025391	0.0034584	0.0366354	0.3541410	0.9837250	9.7523804
12	0.1123047	0.0018863	0.0385217	0.1931547	0.6832379	8.9043474
13	0.1220703	0.0008066	0.0393283	0.0825945	0.3857911	8.1919994
14	0.1318359	0.0007406	0.0400689	0.0758339	0.4870228	7.5851851
15	0.1416016	0.0004843	0.0405531	0.0495886	0.4564652	7.0620689
16	0.1513672	0.0002528	0.0408059	0.0258854	0.3587925	6.6064510
17	0.1611328	0.0000639	0.0408698	0.0065383	0.1419739	6.2060604
18	0.1708984	0.0000229	0.0408927	0.0023450	0.0841850	5.8514280
19	0.1806641	0.0000187	0.0409114	0.0019141	0.1205626	5.5351343
20	0.1904297	0.0000314	0.0409428	0.0032192	0.3563198	5.2512817
21	0.2001953	0.0000253	0.0409681	0.0025872	0.5505835	4.9951210
22	0.2099609	0.0000120	0.0409800	0.0012239	0.4889758	4.7627907
23	0.2197256	0.0	0.0409800	0.0	0.0	4.5511103
24	0.2294922	0.0001245	0.0411045	0.0127469	21.3928833	4.3574467
25	0.2392578	0.0000053	0.0411098	0.0005453	2.0127468	4.1795912
26	0.2490234	0.0	0.0411098	0.0	0.0	4.0156860
27	0.2587891	0.0	0.0411098	0.0	0.0	3.8641500
28	0.2685547	0.0000192	0.0411290	0.0019669	99.3268738	3.7236357
29	0.2783203	0.0	0.0411290	0.0	0.0	3.5929823
30	0.2880859	0.0	0.0411290	0.0	0.0	3.4711857
31	0.2978515	0.0	0.0411290	0.0	0.0	3.3573761
32	0.3076172	0.0	0.0411290	0.0	0.0	3.2507935

PT. SUR 1139 TO 1157 28 AUG., 1949

BAND NO.	FREQUENCY (CPS)	AVG 16 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0078125	0.0015520	0.0015520	0.0993291	0.0998276	128.0000000
2	0.0234375	0.0018209	0.0033729	0.1165360	0.1220624	42.6666565
3	0.0390625	0.0015785	0.0049514	0.1010225	0.1150883	25.5999908
4	0.0546875	0.0127821	0.0177335	0.8180568	1.0611925	18.2857056
5	0.0703125	0.0045429	0.0222764	0.2907484	0.4527084	14.2222214
6	0.0859375	0.0108831	0.0331595	0.6965153	1.3813114	11.6363630
7	0.1015625	0.0523937	0.0855532	3.3531961	9.1008415	9.8461533
8	0.1171875	0.0179382	0.1034913	1.1480436	4.6477804	8.5333328
9	0.1328125	0.0027841	0.1062754	0.1781825	1.1811533	7.5294113
10	0.1484375	0.0005005	0.1067758	0.0320300	0.3904907	6.7368412
11	0.1640625	0.0006485	0.1074243	0.0415041	1.0417643	6.0952377
12	0.1796875	0.0004111	0.1078354	0.0263074	1.5518732	5.5652170
13	0.1953125	0.0007824	0.1086178	0.0500760	7.5501270	5.1199999
14	0.2109375	0.0004971	0.1091149	0.0318153	13.5477962	4.7407398
15	0.2265625	0.0003315	0.1094463	0.0212171	29.9187775	4.4137926
16	0.2421875	0.0000666	0.1095129	0.0042635	19.6497650	4.1290321
17	0.2578125	0.0000074	0.1095203	0.0004768	7.8570194	3.8787870
18	0.2734375	0.0001468	0.1096671	0.0093952	671.6816406	3.6571426
19	0.2890625	0.0003030	0.1099700	0.0193890	3665.2263184	3.4594593
20	0.3046875	0.0005605	0.1105304	0.0358699	21224.7890625	3.2820511

PT. SUR 1139 TO 1157 28 AUG., 1949

BAND NO.	FREQUENCY (CPS)	AVG	IC VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0048828		0.0010882	0.0010882	0.1114283	0.1116514	204.7999878
2	0.0146484		0.0014225	0.0025107	0.1456424	0.1482902	68.2666626
3	0.0244141		0.0008552	0.0033659	0.0875741	0.0920660	40.9599915
4	0.0341797		0.0004729	0.0038388	0.0484276	0.0534679	29.2571411
5	0.0439453		0.0013445	0.0051833	0.1376785	0.1624870	22.7555542
6	0.0537109		0.0032017	0.0083850	0.3278548	0.4213528	18.6181793
7	0.0634766		0.0103550	0.0187400	1.0603485	1.5139141	15.7538452
8	0.0732422		0.0035365	0.0222764	0.3621343	0.5872168	13.6533327
9	0.0830078		0.0052122	0.0274886	0.5337245	1.0067906	12.0470581
10	0.0927734		0.0160597	0.0435483	1.6445141	3.7087950	10.7789469
11	0.1025391		0.0284710	0.0720193	2.9154291	8.0984135	9.7523804
12	0.1123047		0.0229534	0.0949727	2.3504295	8.3140745	8.9043474
13	0.1220703		0.0094355	0.1044081	0.9661945	4.5130024	8.1919994
14	0.1318359		0.0014512	0.1058593	0.1486015	0.9543532	7.5851851
15	0.1416016		0.0007942	0.1066535	0.0813237	0.7485876	7.0620689
16	0.1513672		0.0001224	0.1067753	0.0125328	0.1737143	6.6064510
17	0.1611328		0.0003710	0.1071468	0.0379926	0.8249720	6.2060604
18	0.1708984		0.0004169	0.1075636	0.0426878	1.5324678	5.8514280
19	0.1806641		0.0002717	0.1078352	0.0278180	1.7522020	5.5351343
20	0.1904297		0.0002600	0.1080952	0.0266252	2.9470625	5.2512817
21	0.2001953		0.0005300	0.1086252	0.0542750	11.5502672	4.9951210
22	0.2099609		0.0003492	0.1089744	0.0357580	14.2860584	4.7627907
23	0.2197266		0.0003410	0.1093153	0.0349154	27.8146820	4.5511103
24	0.2294922		0.0001308	0.1094462	0.0133989	22.4870758	4.3574467
25	0.2392578		0.0000121	0.1094583	0.0012430	4.5879078	4.1795912
26	0.2490234		0.0000545	0.1095127	0.0055785	46.8674164	4.0156860
27	0.2587891		0.0000074	0.1095201	0.0007629	14.5537710	3.8641500
28	0.2685547		0.0000508	0.1095708	0.0051986	262.5241699	3.7236357
29	0.2783203		0.0001336	0.1097044	0.0136803	1183.4204102	3.5929823
30	0.2880859		0.0001952	0.1098995	0.0199842	3947.4934082	3.4711857
31	0.2978516		0.0002794	0.1101789	0.0286135	11909.8906250	3.3573761
32	0.3076172		0.0003513	0.1105302	0.0359699	25833.0546875	3.2507935

PT. SUR 1201 TO 1219 30 AUG., 1949

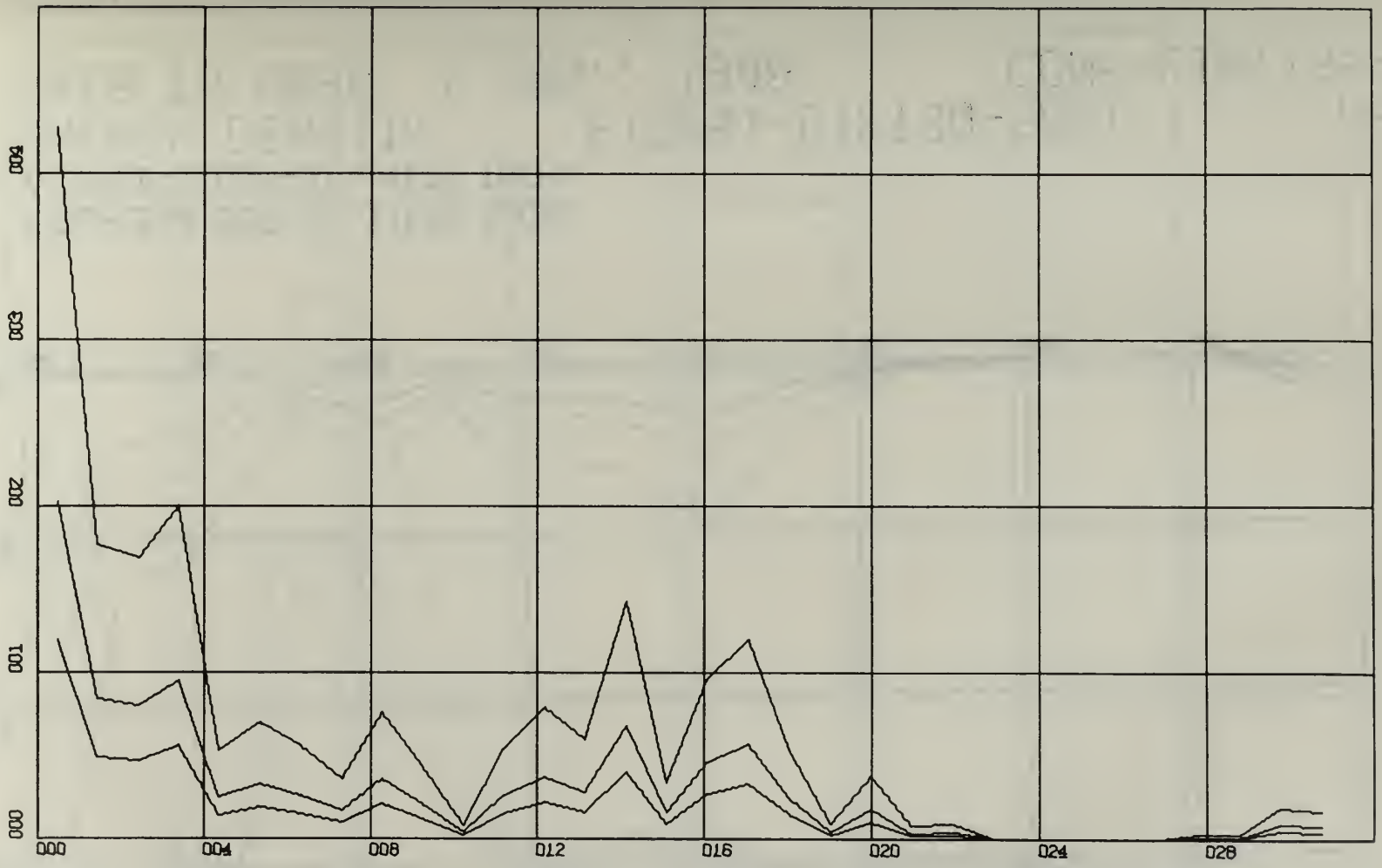
BAND NO.	FREQUENCY (CPS)	AVG 16 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0078125	0.0013306	0.0013306	0.0851598	0.0855872	128.0000000
2	0.0234375	0.0005586	0.0018892	0.0357521	0.0374475	42.6666565
3	0.0390625	0.0005551	0.0024443	0.0355258	0.0404722	25.5999908
4	0.0546875	0.0132261	0.0156705	0.8464723	1.0980539	18.2857056
5	0.0703125	0.0303098	0.0459802	1.9398260	3.0203972	14.2222214
6	0.0859375	0.0015072	0.0474875	0.0964618	0.1913006	11.6363630
7	0.1015625	0.0008290	0.0483164	0.0530528	0.1439396	9.8461533
8	0.1171875	0.0012865	0.0496029	0.0823383	0.3333412	8.5333328
9	0.1328125	0.0030106	0.0526135	0.1926752	1.2772245	7.5294113
10	0.1484375	0.0011798	0.0537933	0.0755099	0.9205723	6.7368412
11	0.1640625	0.0006361	0.0544294	0.0407091	1.0218096	6.0952377
12	0.1796875	0.0000907	0.0545201	0.0058069	0.3425470	5.5652170
13	0.1953125	0.0000673	0.0545875	0.0043103	0.6498740	5.1199999
14	0.2109375	0.0000754	0.0546628	0.0048232	2.0538607	4.7407398
15	0.2265625	0.0000190	0.0546819	0.0012187	1.7185364	4.4137926
16	0.2421875	0.0000359	0.0547178	0.0022986	10.5941515	4.1290321
17	0.2578125	0.0000305	0.0547483	0.0019547	32.2104950	3.8787870
18	0.2734375	0.0000007	0.0547490	0.0000432	3.0884399	3.6571426
19	0.2890625	0.0000491	0.0547981	0.0031441	594.3564453	3.4594593
20	0.3046875	0.0000282	0.0548263	0.0018037	1067.2624512	3.2820511

PT. SUR 1201 TO 1219 30 AUG., 1949

BAND NO.	FREQUENCY (CPS)	AVG 10 VALUE (FTSQ)	CUM VALUE (FTSQ)	ENERGY DENSITY (FTSQ-SEC)	SURFACE VALUE (FTSQ-SEC)	PERIOD (SEC)
1	0.0048828	0.0010190	0.0010190	0.1043432	0.1045521	204.7999878
2	0.0146484	0.0004663	0.0014853	0.0477523	0.0486138	68.2666626
3	0.0244141	0.0004039	0.0018892	0.0413635	0.0434852	40.9599915
4	0.0341797	0.0003520	0.0022413	0.0360453	0.0397968	29.2571411
5	0.0439453	0.0041287	0.0063700	0.4227833	0.4989651	22.7555542
6	0.0537109	0.0083172	0.0146872	0.8516800	1.0945625	18.6181793
7	0.0634766	0.0218287	0.0365158	2.2352533	3.1913872	15.7538452
8	0.0732422	0.0094645	0.0459803	0.9691627	1.5715399	13.6533327
9	0.0830078	0.0012963	0.0472766	0.1327444	0.2503998	12.0470581
10	0.0927734	0.0005331	0.0478097	0.0545894	0.1231461	10.7789469
11	0.1025391	0.0004747	0.0482845	0.0486127	0.1350353	9.7523804
12	0.1123047	0.0006056	0.0488901	0.0620161	0.2193670	8.9043474
13	0.1220703	0.0011357	0.0500258	0.1162916	0.5431868	8.1919994
14	0.1318359	0.0019042	0.0519299	0.1949865	1.2522478	7.5851851
15	0.1416016	0.0010317	0.0529616	0.1056433	0.9724503	7.0620689
16	0.1513672	0.0008318	0.0537934	0.0851772	1.1806221	6.6064510
17	0.1611328	0.0002996	0.0540930	0.0306751	0.6660797	6.2060604
18	0.1708984	0.0003460	0.0544390	0.0354328	1.2720156	5.8514280
19	0.1806641	0.0000812	0.0545202	0.0083177	0.5239141	5.5351343
20	0.1904297	0.0000640	0.0545842	0.0065528	0.7253125	5.2512817
21	0.2001953	0.0000034	0.0545875	0.0003436	0.0731201	4.9951210
22	0.2099609	0.0	0.0545875	0.0	0.0	4.7627907
23	0.2197266	0.0000754	0.0546629	0.0077172	6.1477404	4.5511103
24	0.2294922	0.0000190	0.0546819	0.0019499	3.2725430	4.3574467
25	0.2392578	0.0	0.0546819	0.0	0.0	4.1795912
26	0.2490234	0.0000665	0.0547484	0.0068053	57.1737671	4.0156860
27	0.2587891	0.0	0.0547484	0.0	0.0	3.8641500
28	0.2685547	0.0000007	0.0547491	0.0000691	3.4904566	3.7236357
29	0.2783203	0.0000255	0.0547746	0.0026151	226.2230835	3.5929823
30	0.2880859	0.0000236	0.0547982	0.0024155	477.1345215	3.4711857
31	0.2978516	0.0	0.0547982	0.0	0.0	3.3573761
32	0.3076172	0.0000282	0.0548264	0.0028859	2072.5925293	3.2507935

APPENDIX II

GRAPHIC DISPLAY OF SPECTRAL COMPONENTS FOR SELECTED INTERVALS



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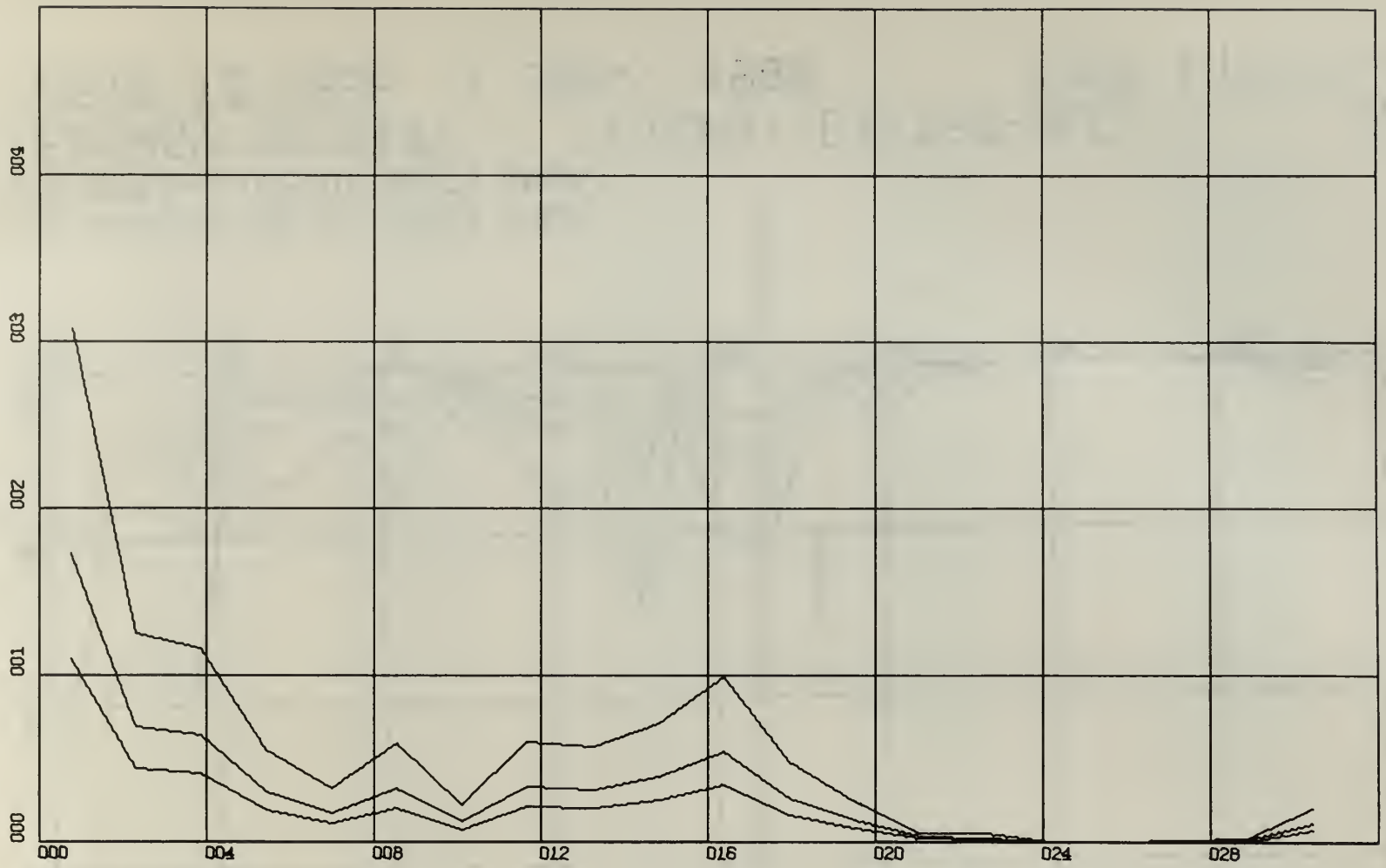

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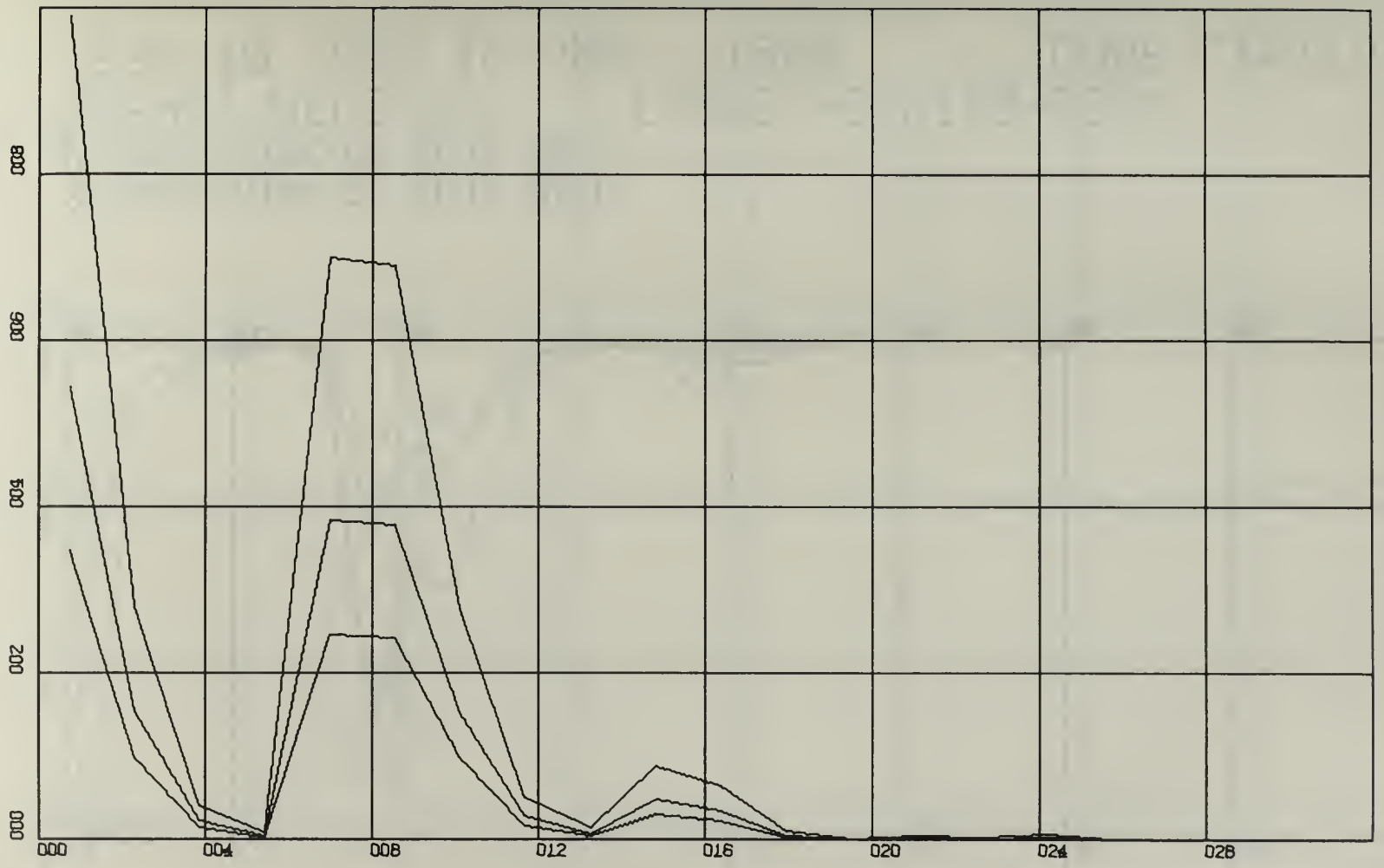

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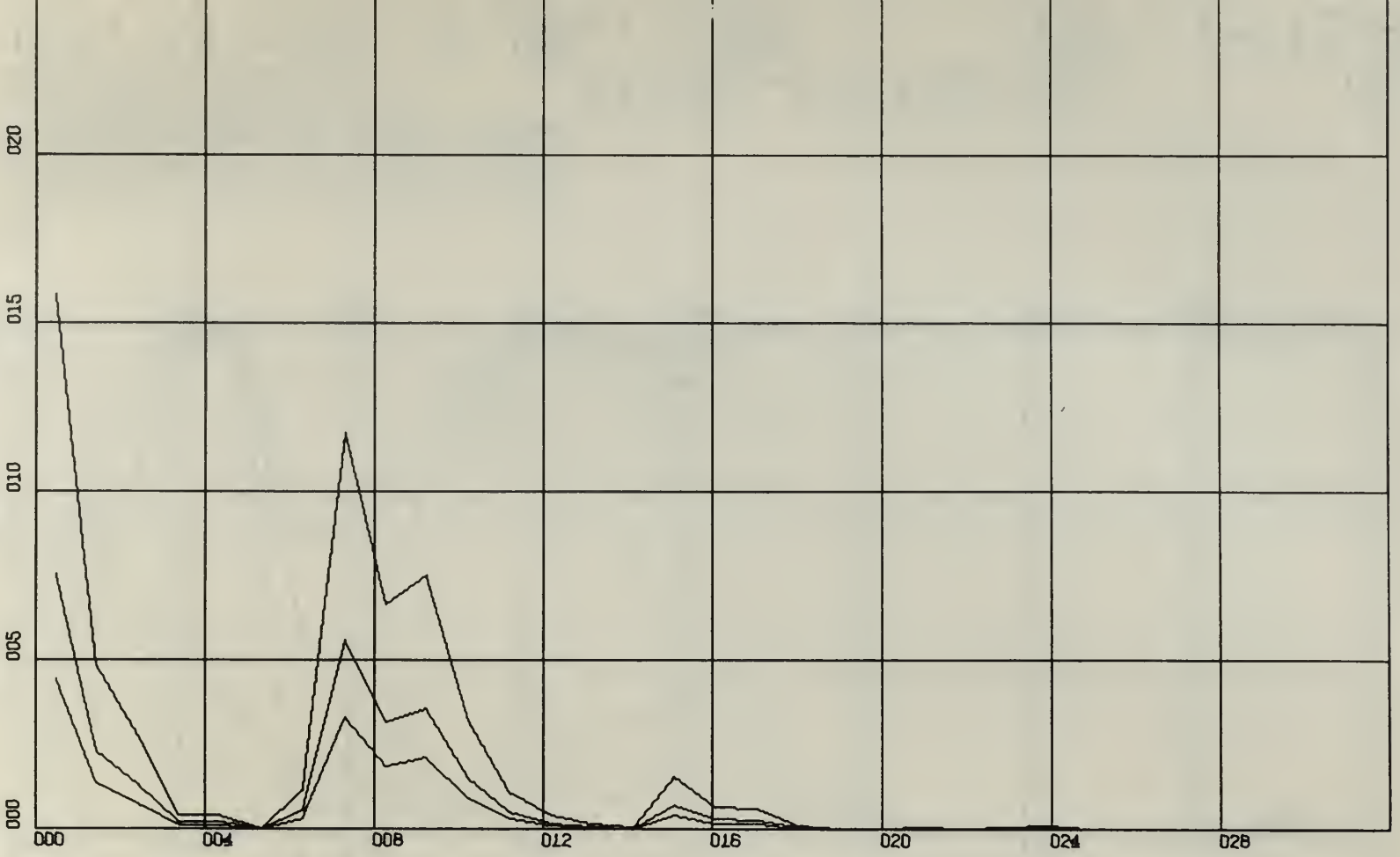

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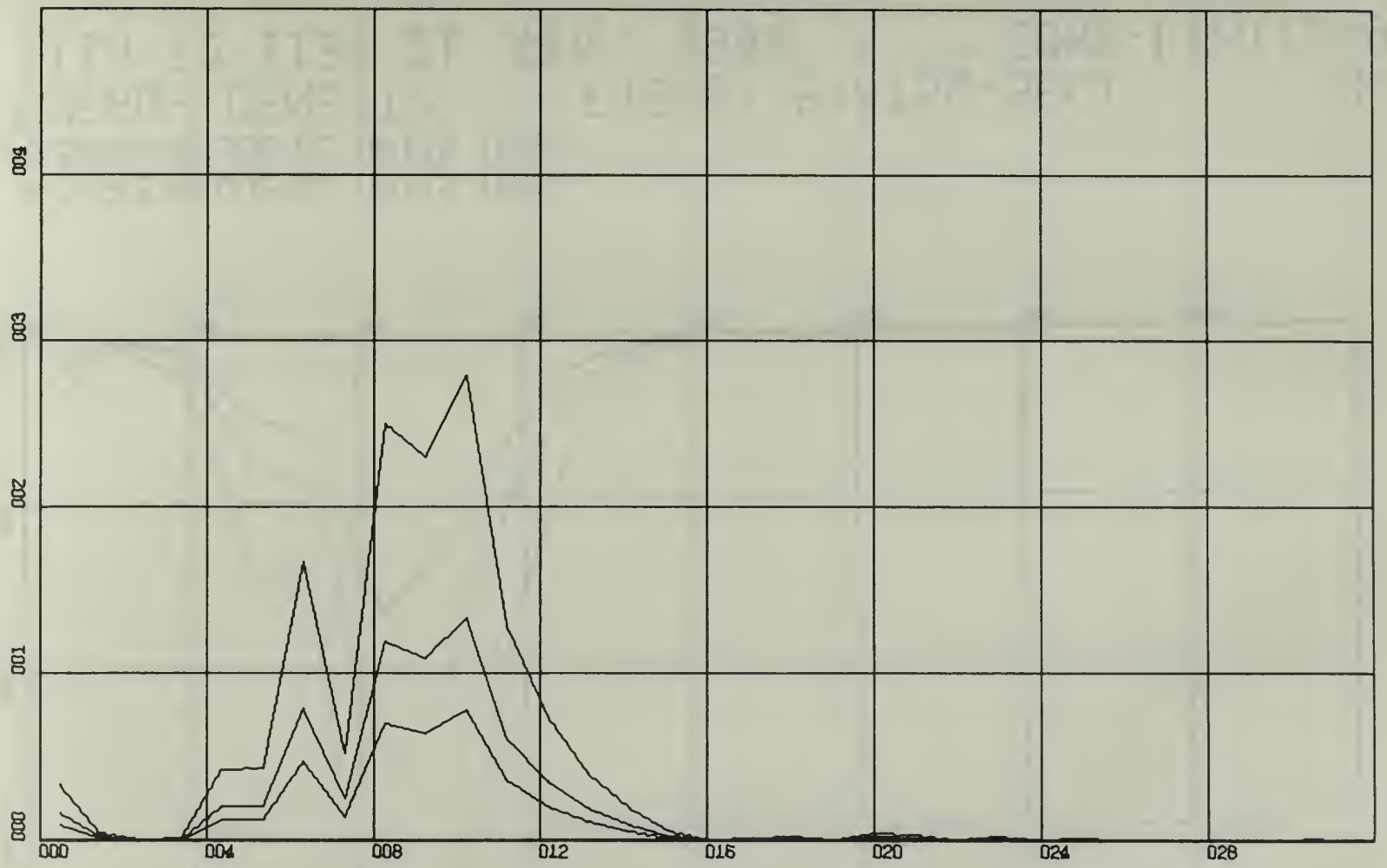

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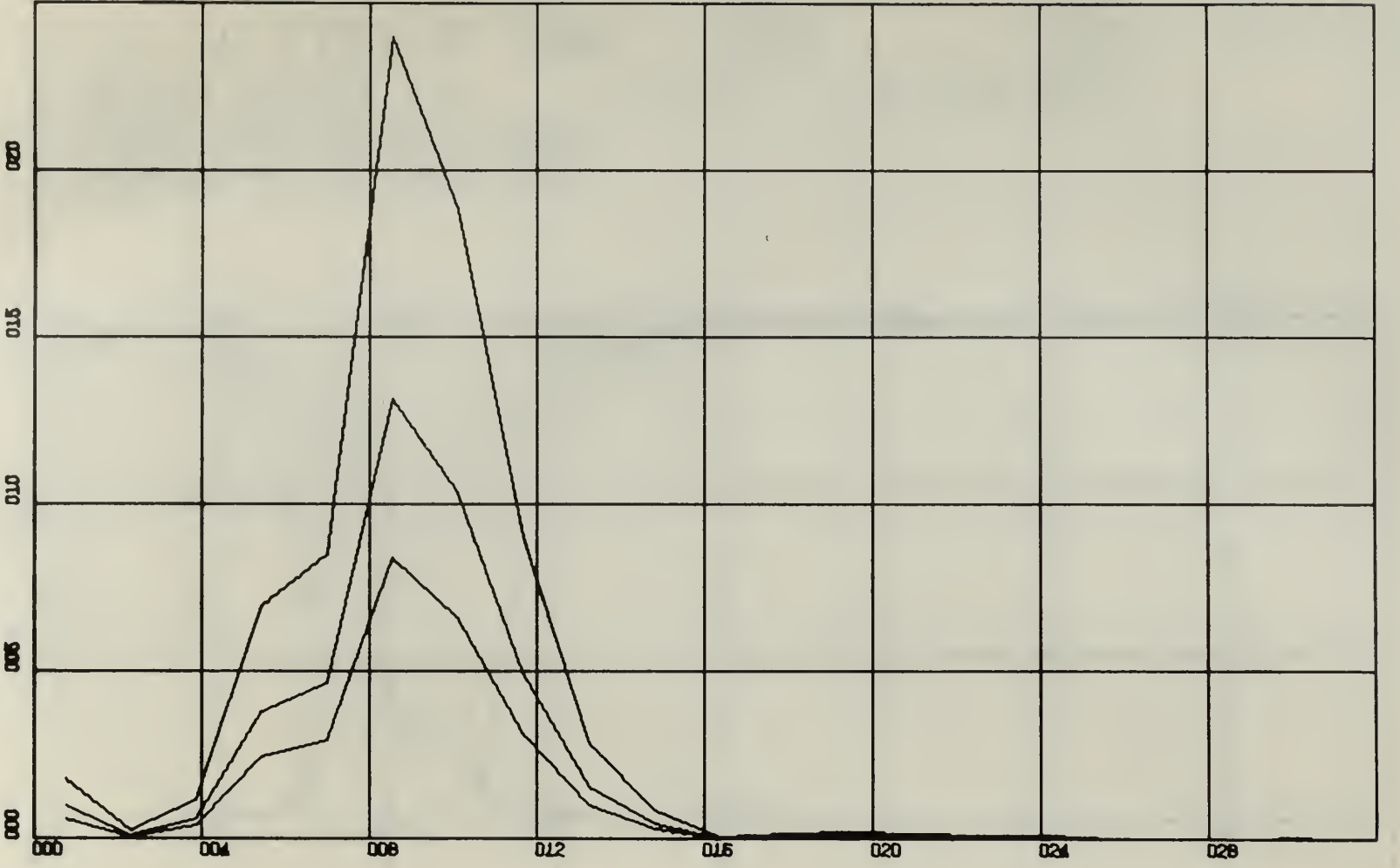

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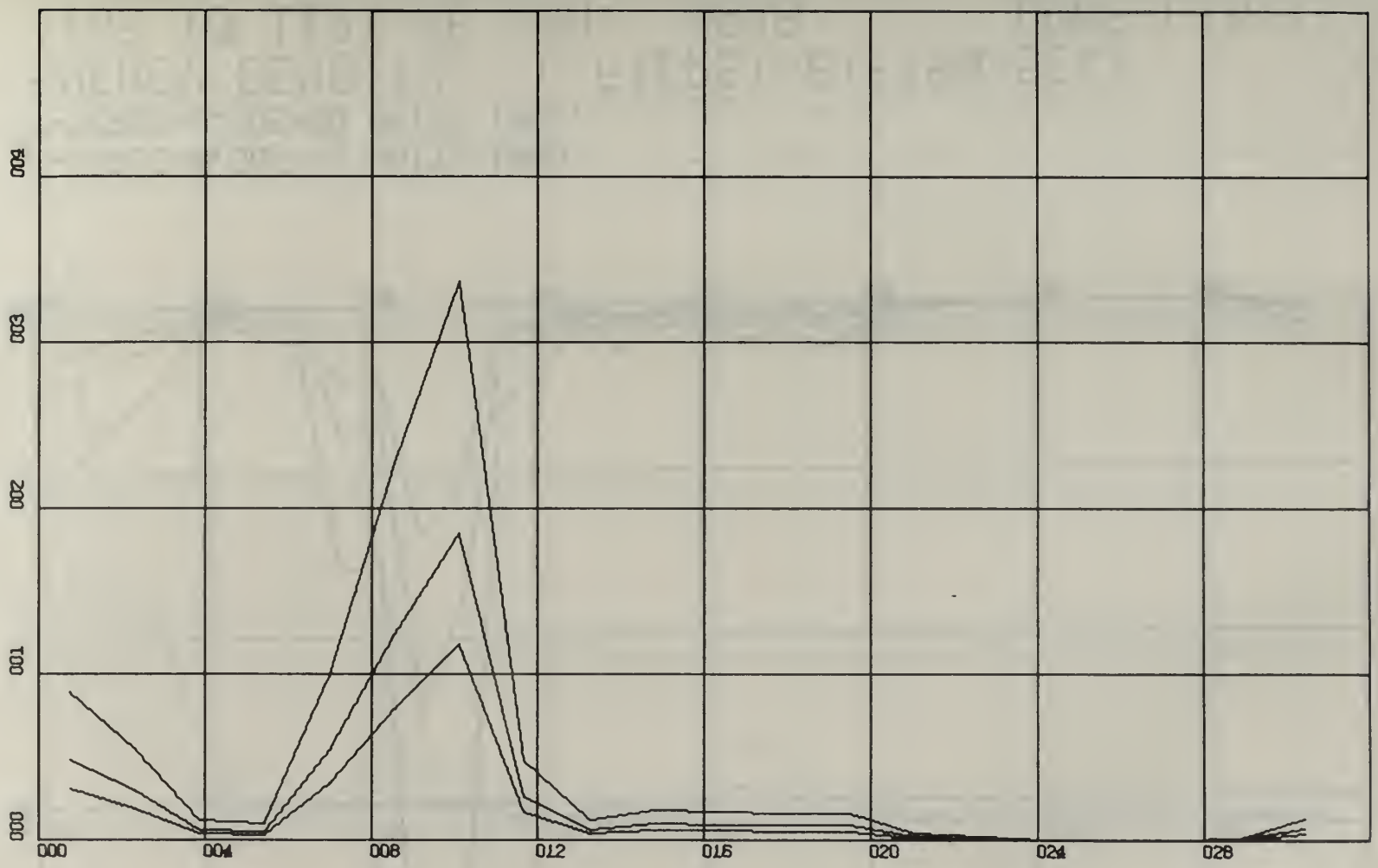

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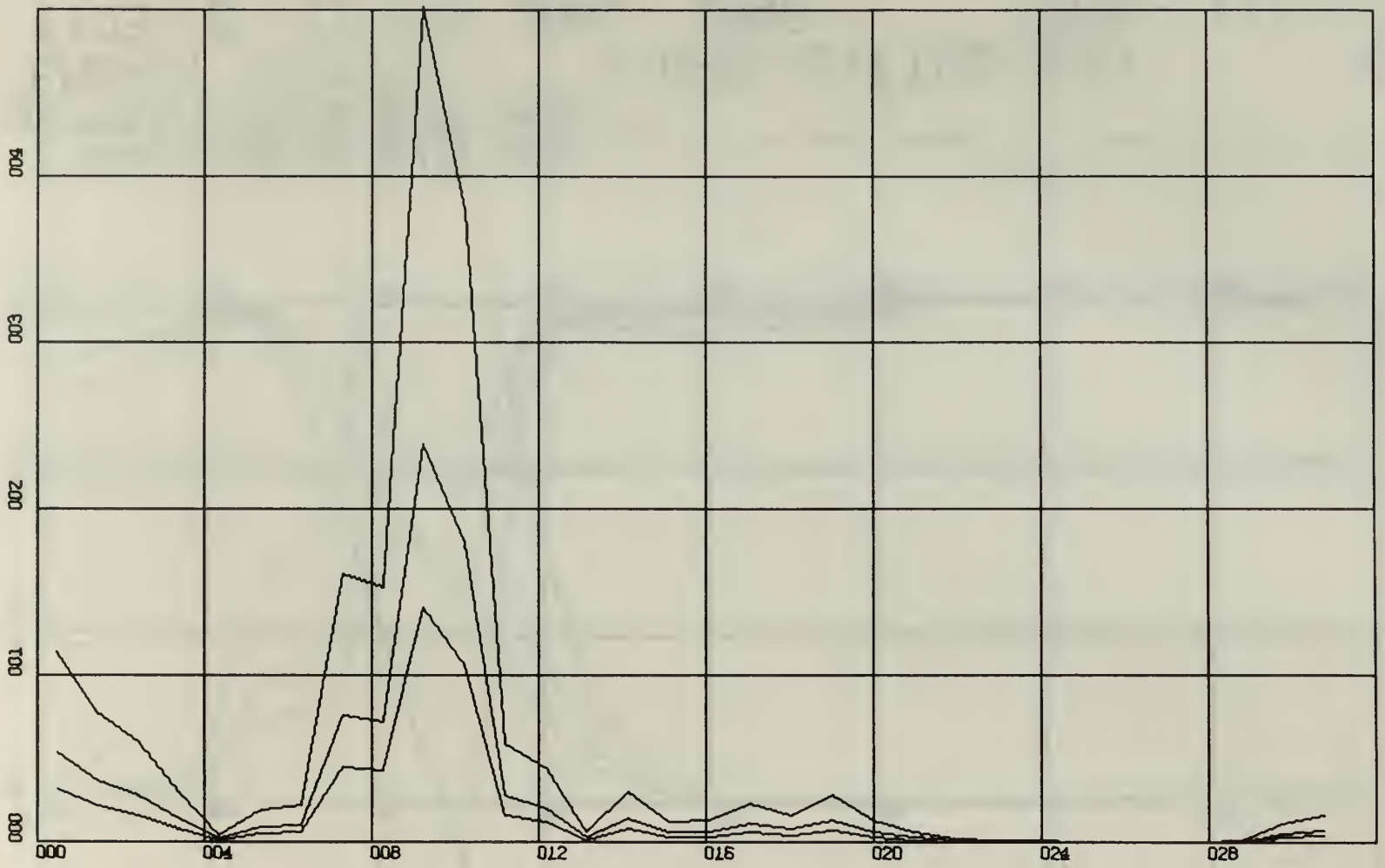
1103 TO 1121 26 JAN., 1948 CONF-LIMITS=95%



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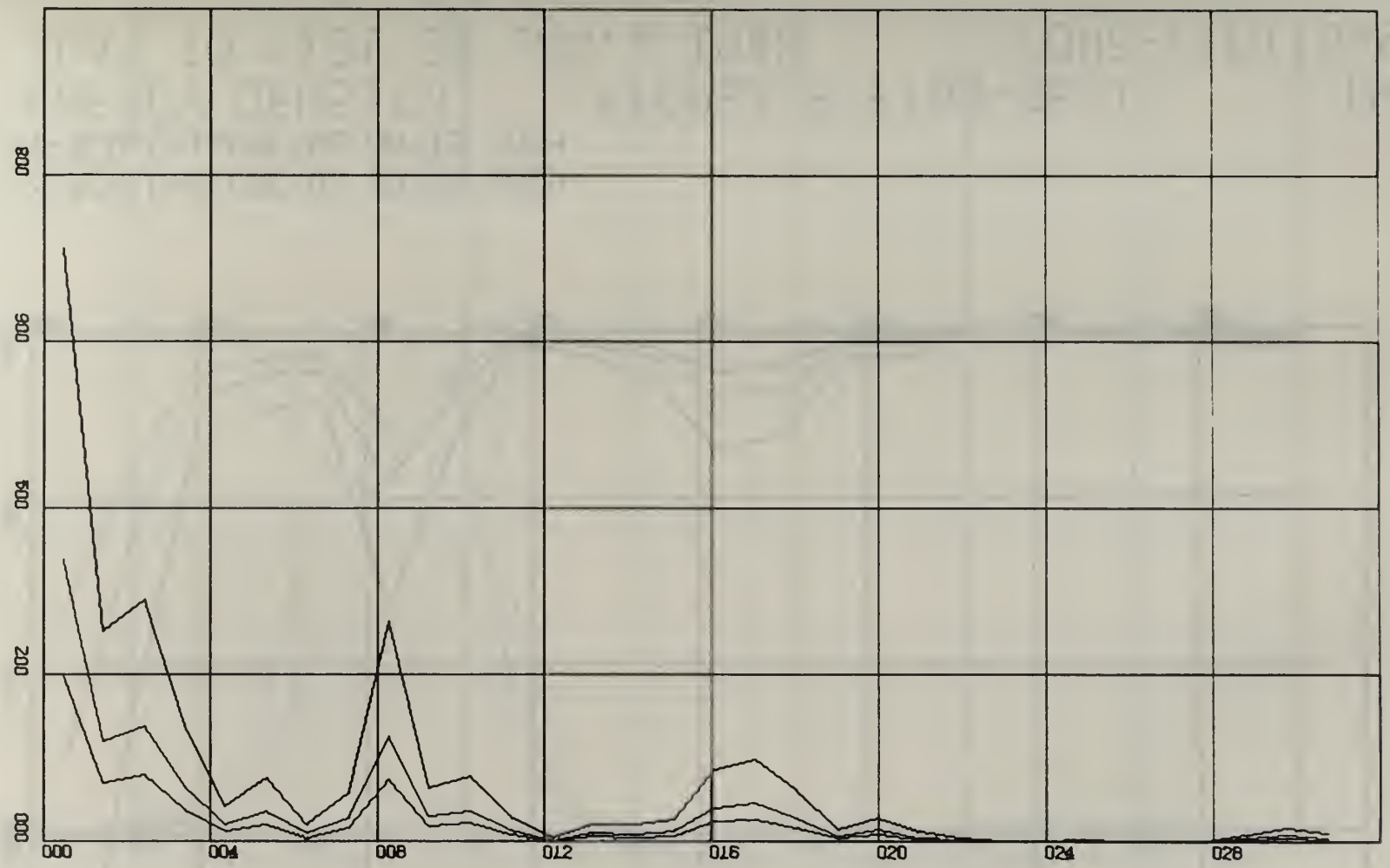

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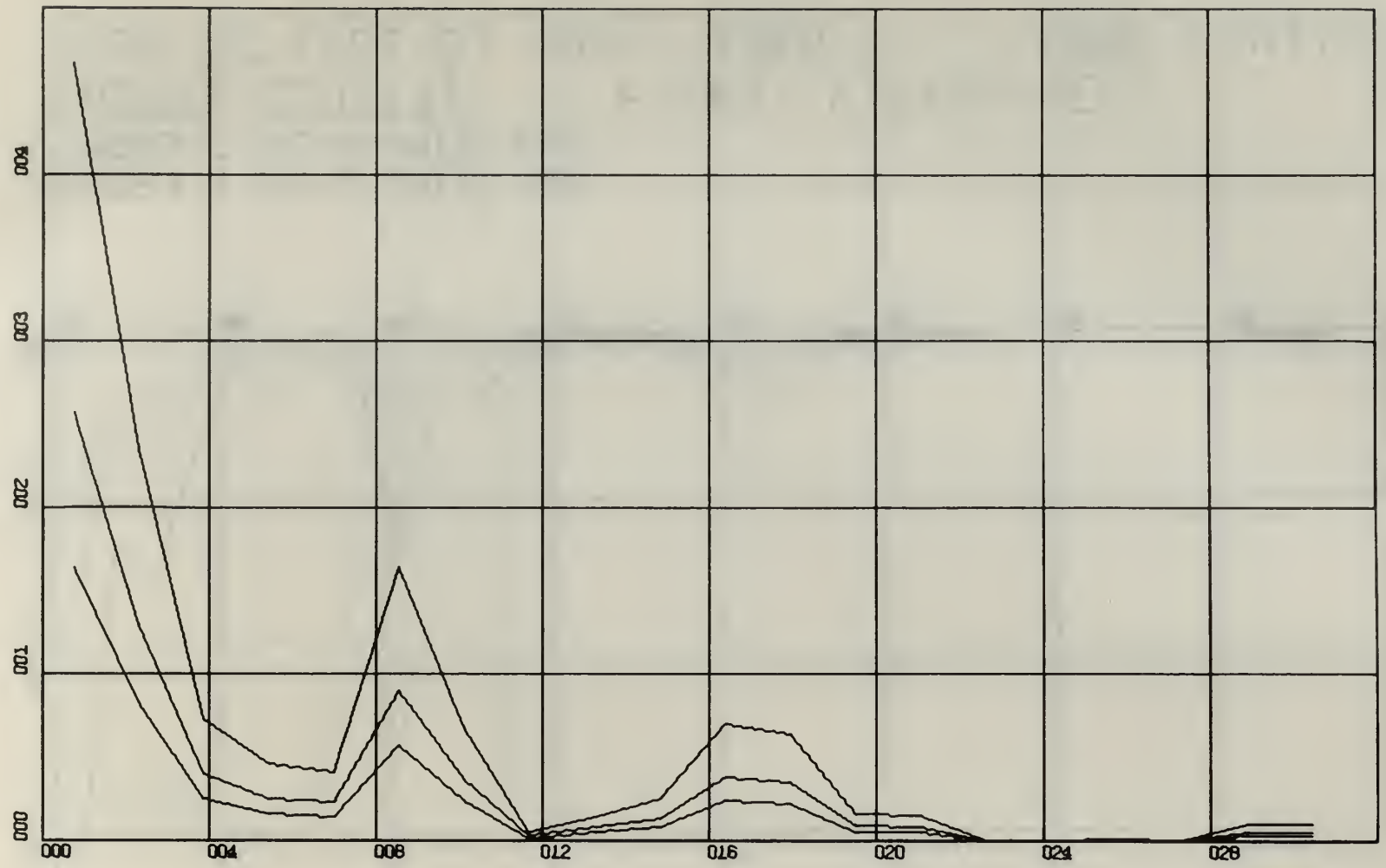
1043 TO 1101 31 JAN., 1948 CONF-LIMITS=95%



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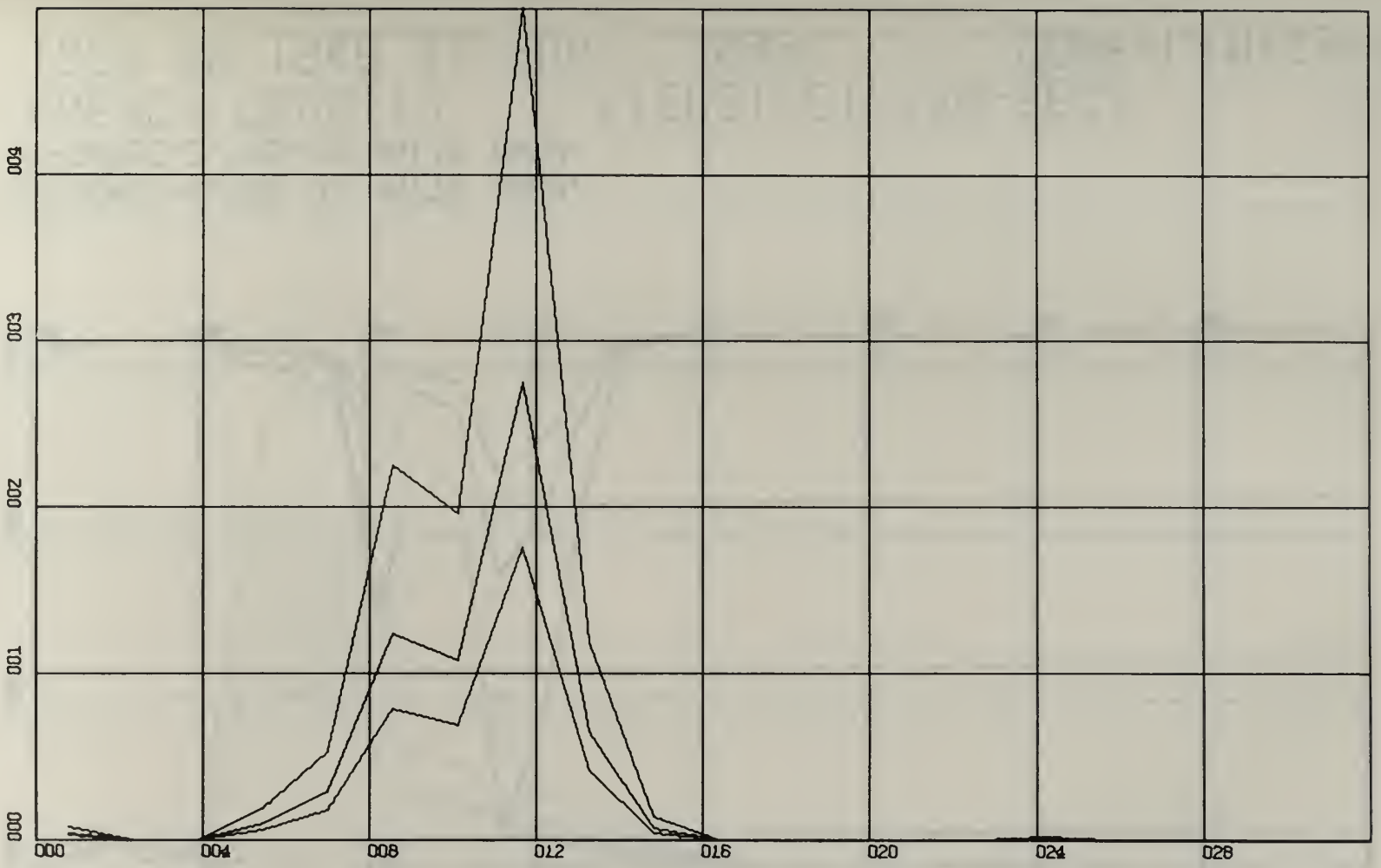
1043 TO 1101 31 JAN., 1948 CONF-LIMITS=95%



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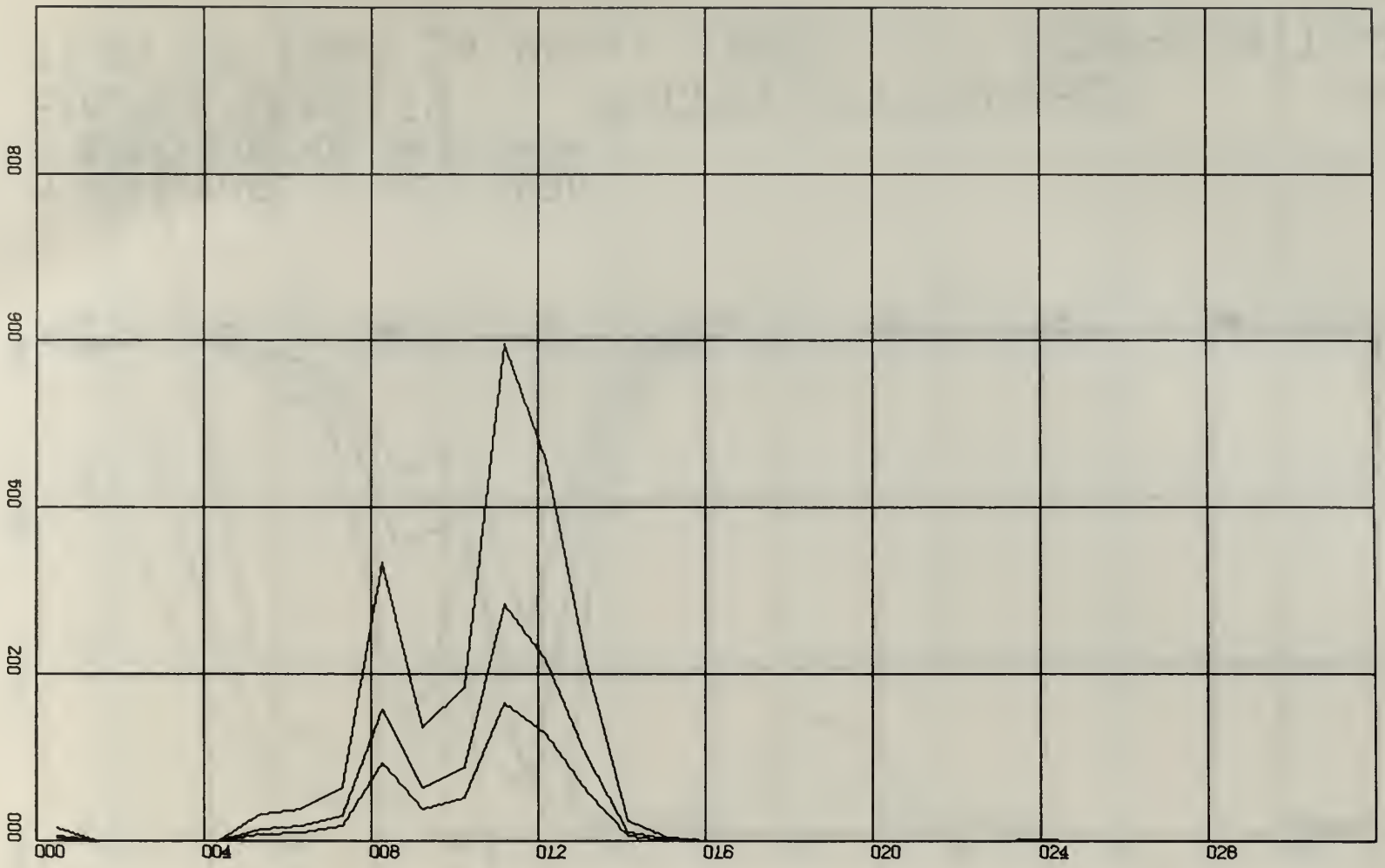
1528 TO 1546 14 AUG., 1949 CONF-LIMITS=95%



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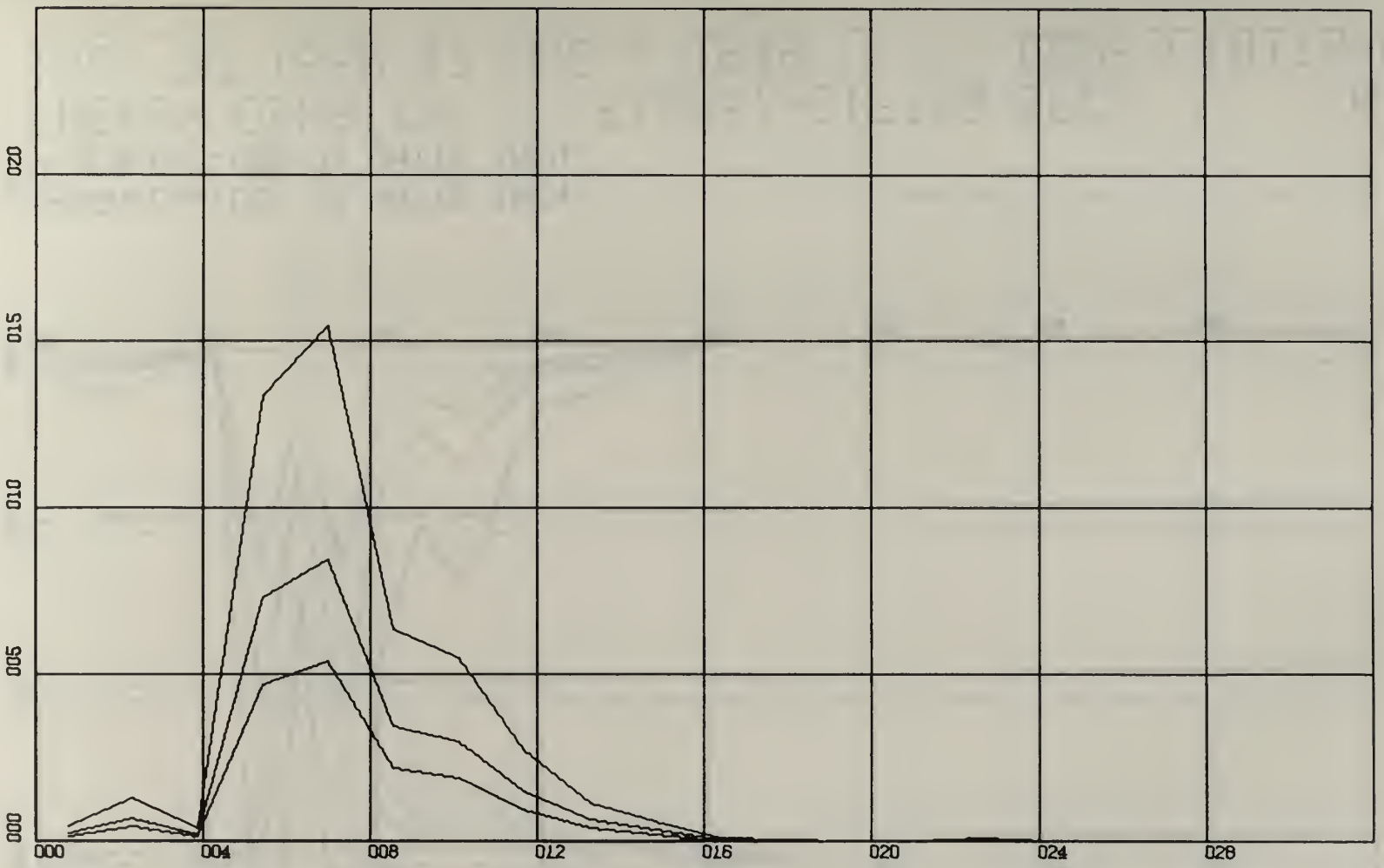
1528 TO 1546 14 AUG., 1949 CONF-LIMITS=95%



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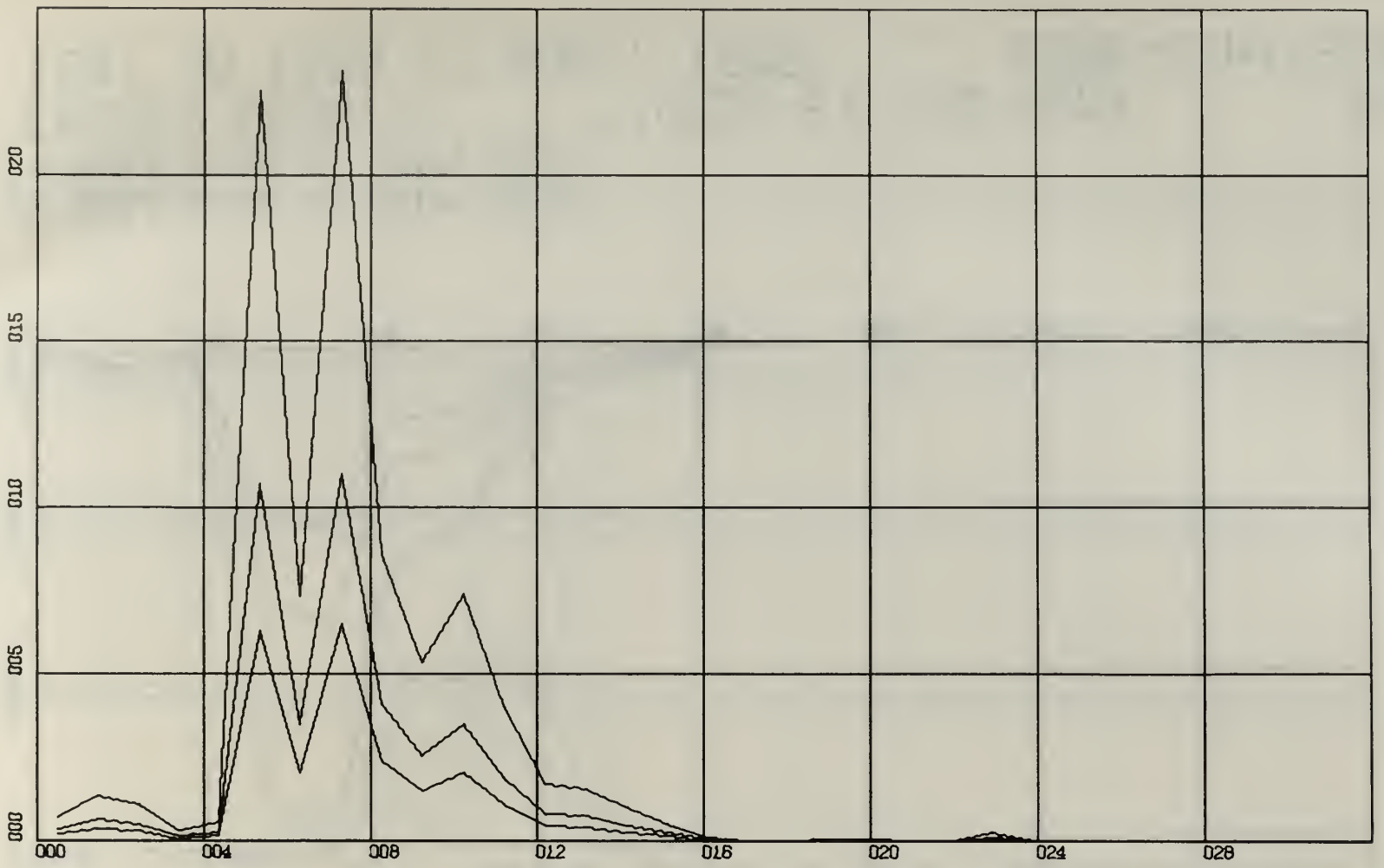

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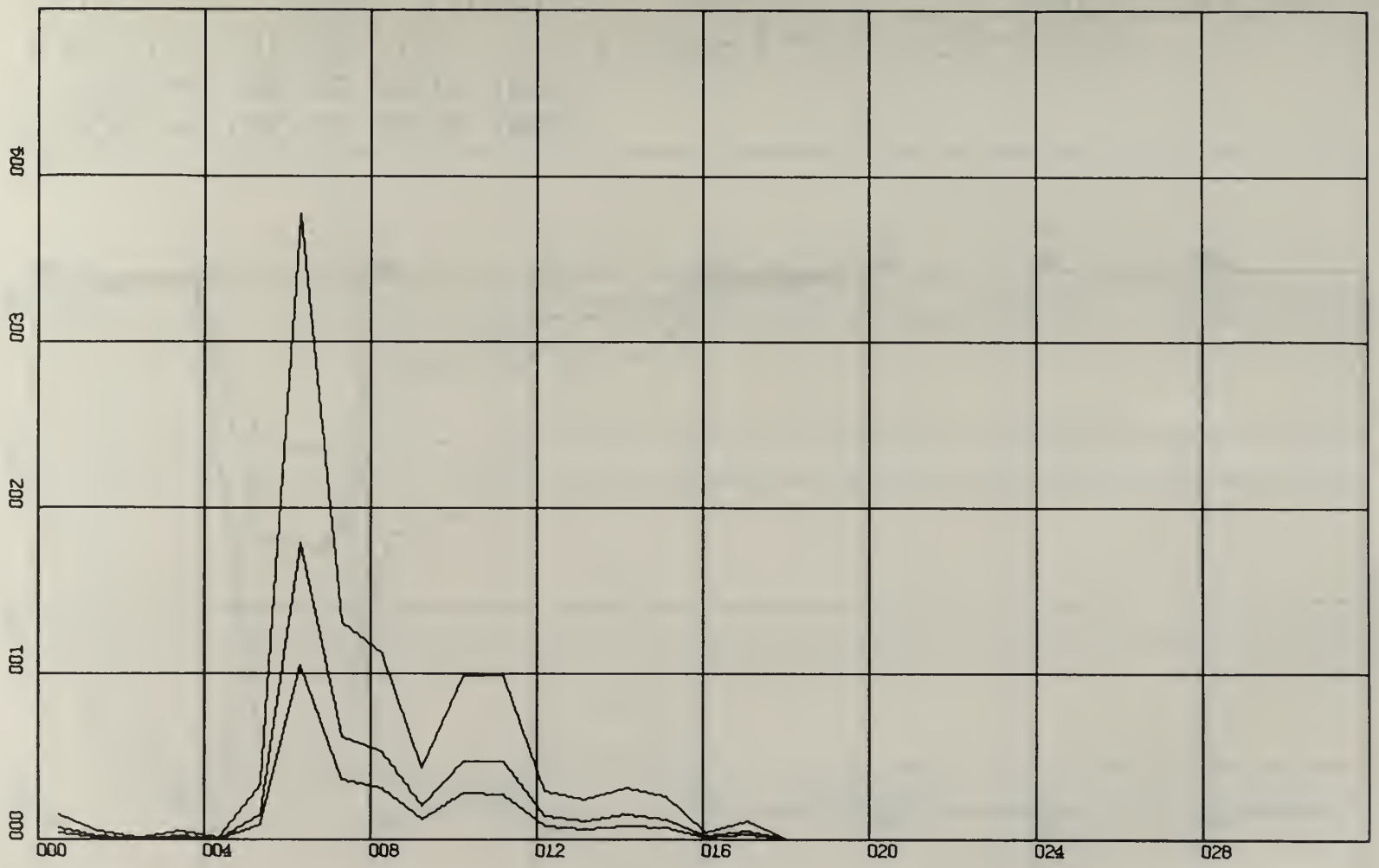

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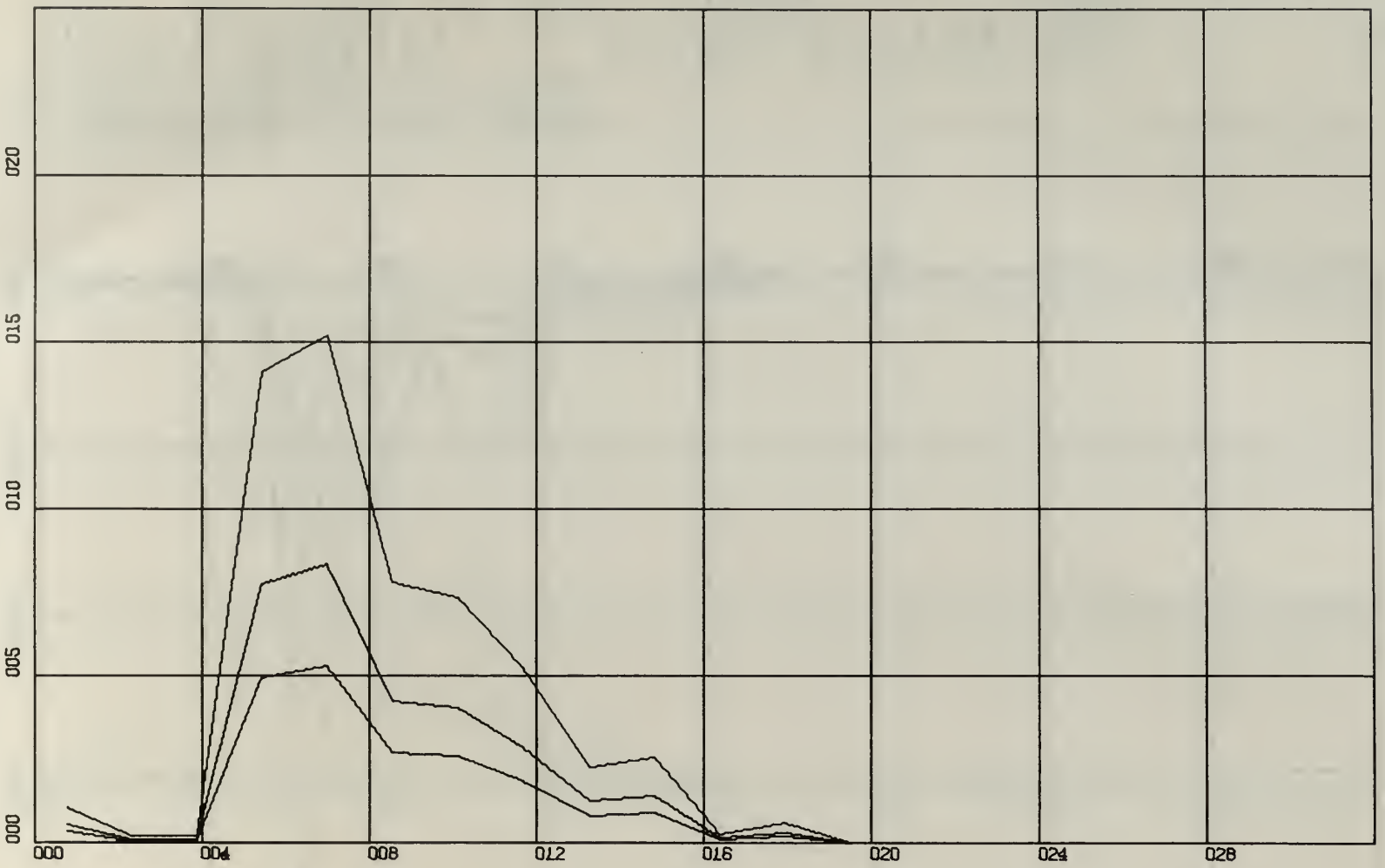
0942 TO 1000 19 AUG., 1949 CONF-LIMITS=95%



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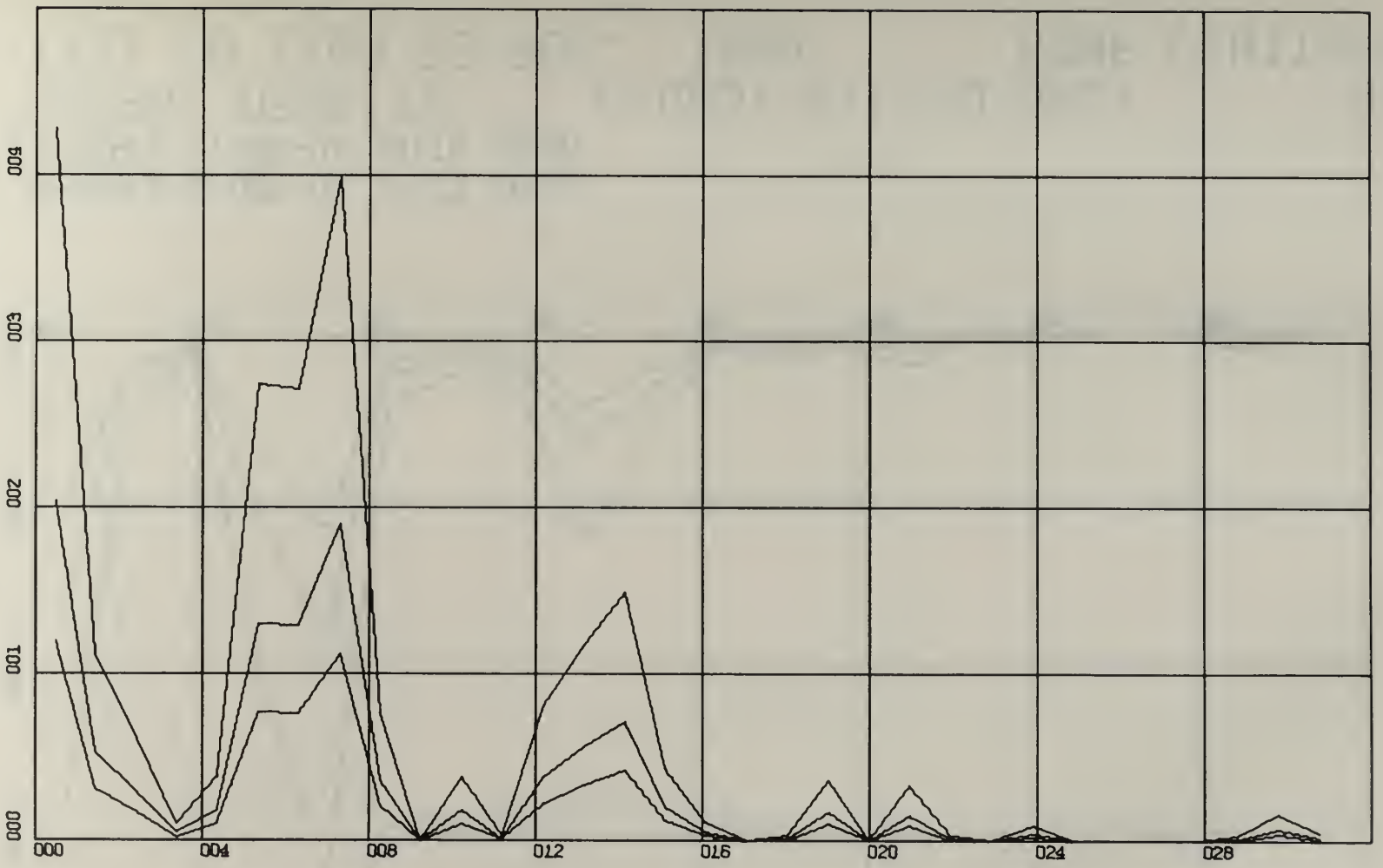

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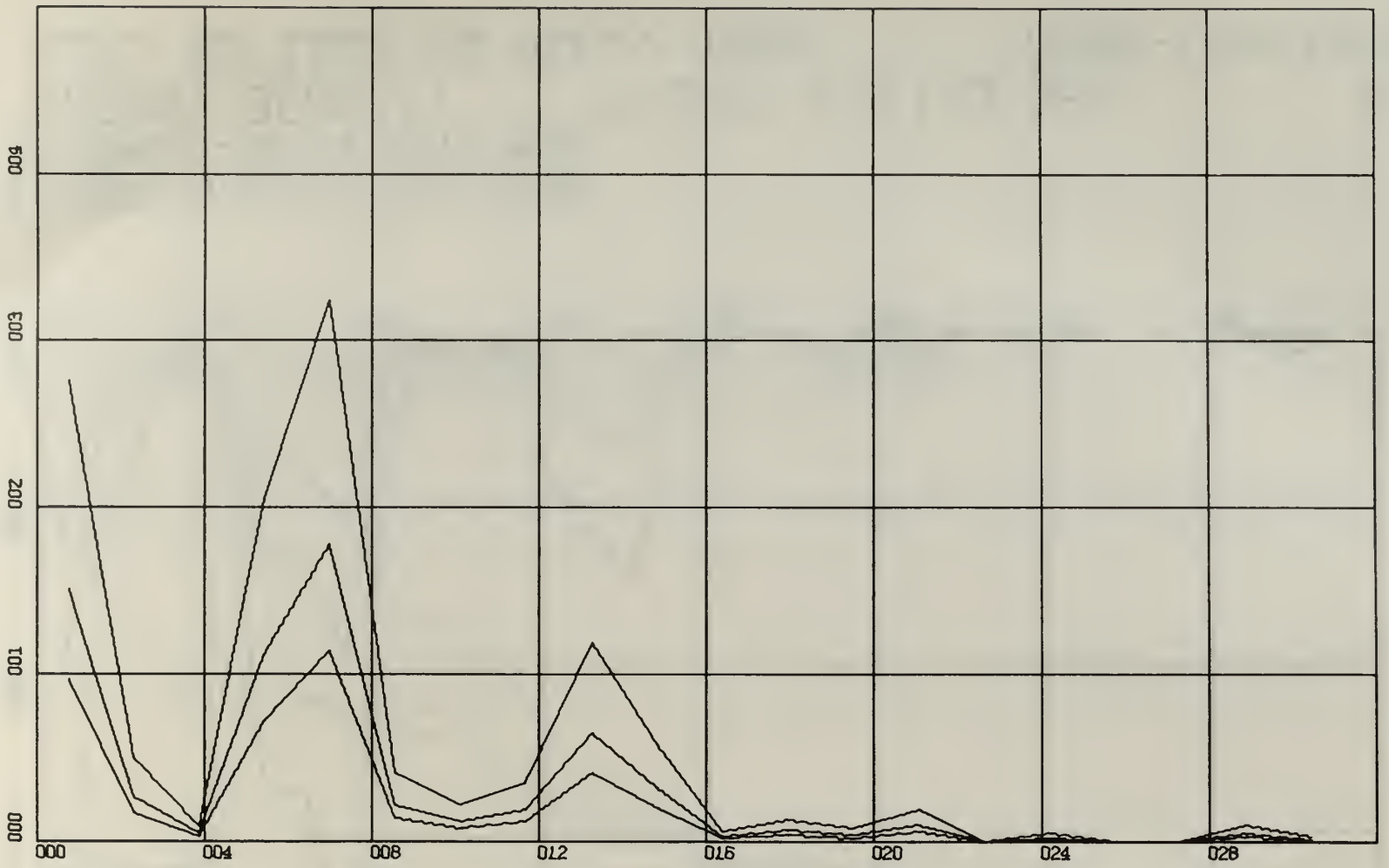
1131 TO 1149 23 AUG., 1949 CONF-LIMITS=95%



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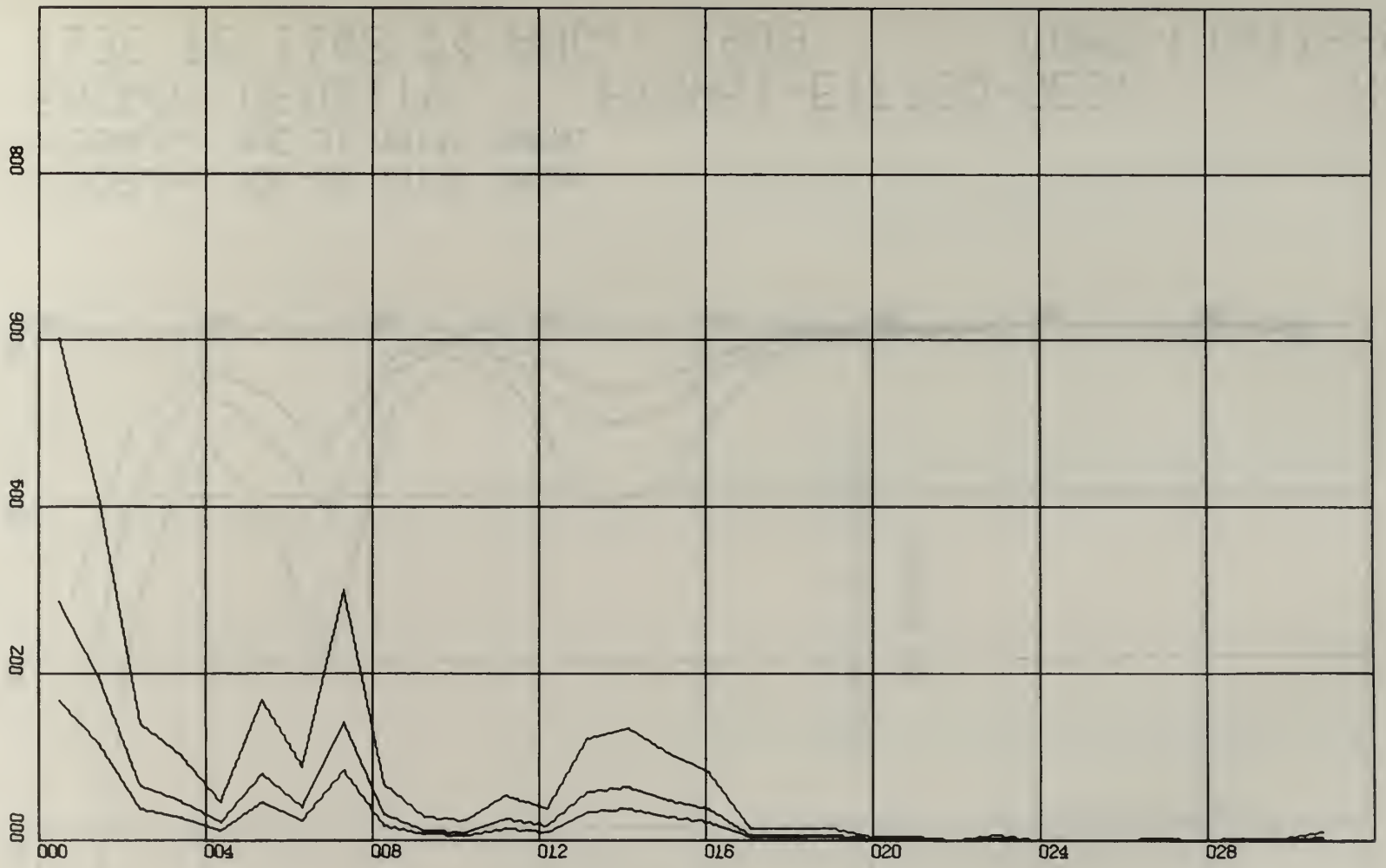

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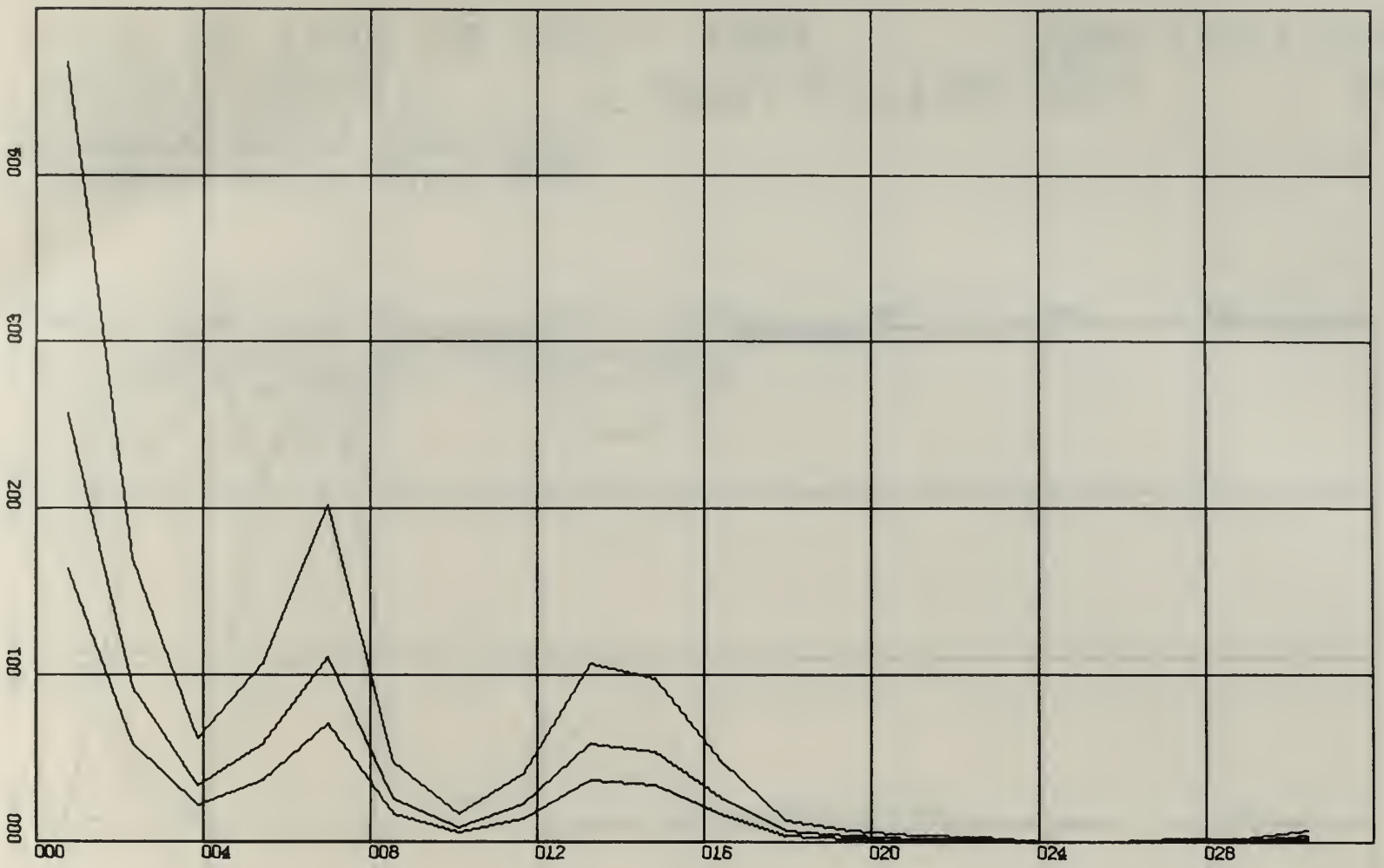
1130 TO 1148 24 AUG., 1949 CONF-LIMITS=95%



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1130 TO 1148 24 AUG., 1949 CONF-LIMITS=95%

APPENDIX III

SUMMARIES OF H3B AND H3S

SUMMARY OF H3B AND H3S FOR NOVEMBER, 1947

Date	Time (PCT)	H3B (ft.)	H3S (ft.)
2	1138 - 1156	1.299	12.528
5	1124 - 1142	0.436	9.969
6	1147 - 1205	0.621	7.408
7	1143 - 1201	0.413	5.008
8	1143 - 1201	0.417	2.766
9	1142 - 1200	1.075	6.531
10	1150 - 1208	0.995	6.224
11	1145 - 1203	0.575	2.687
12	1142 - 1200	0.754	8.125
13	1201 - 1219	0.597	4.922
14	1800 - 1818	0.853	7.186
15	1202 - 1220	1.022	5.042
16	1153 - 1211	0.971	8.036
17	1805 - 1823	0.820	5.255
18	0854 - 0912	1.121	10.150
19	2103 - 2112	0.768	13.533
20	1459 - 1517	1.148	6.693
21	1456 - 1514	1.382	5.597
22	1519 - 1537	1.036	4.355
23	1617 - 1635	0.727	1.738
24	1605 - 1623	0.588	2.917

SUMMARY OF H3B AND H3S FOR DECEMBER, 1947

Date	Time (PCT)	H3B (ft.)	H3S (ft.)
12	1323 - 1341	1.718	5.811
13	1340 - 1349*	1.105	4.210
14	1305 - 1323	1.326	3.591
15	1820 - 1838	1.827	6.085
16	1804 - 1822	1.337	5.053
22	1102 - 1119	2.306	9.341
23	1107 - 1116*	2.021	14.192
24	2009 - 2027	2.491	10.419
25	0804 - 0822	1.119	7.215
26	1421 - 1439	0.794	2.902
27	1418 - 1436	1.100	1.936
28	1421 - 1439	0.875	3.482
29	2022 - 2040	1.920	10.276
30	1420 - 1438	1.119	3.283
31	1410 - 1428	0.473	1.679

* - Record doubled

SUMMARY OF H3B AND H3S FOR JANUARY, 1948

Date	Time (PCT)	H3B (ft.)	H3S (ft.)
1	0818 - 0836	0.278	1.206
2	0814 - 0832	1.159	6.309
3	1428 - 1446	3.213	11.573
4	1422 - 1440	2.795	13.434
5	0820 - 0838	1.840	5.140
6	1432 - 1450	0.951	4.811
7	1610 - 1628	1.572	7.384
8	1005 - 1023	1.804	6.387
9	0943 - 1001	2.458	9.805
10	1634 - 1652	1.492	5.567
11	1610 - 1628	1.274	5.089
12	1042 - 1100	1.459	3.957
13	1056 - 1114	0.785	1.607
14	1043 - 1101	0.589	0.861
15	1642 - 1700	0.653	2.027
16	1641 - 1659	0.585	2.296
17	2243 - 2251	1.147	3.846
18	0446 - 0504	1.079	4.346
19	0442 - 0500	1.208	2.503
20	1042 - 1100	0.830	2.991
21	1115 - 1133	0.721	2.538
22	1111 - 1129	1.271	2.398
23	1110 - 1128	1.135	4.344
24	0510 - 0528	1.489	7.089
25	1105 - 1123	1.208	6.737
26	1103 - 1121	0.822	3.265
27	1105 - 1123	1.456	2.897
28	1102 - 1120	1.155	4.869
29	1043 - 1101	1.809	3.982
30	1046 - 1104	1.369	5.709
31	1043 - 1101	0.958	3.364

SUMMARY OF H3B AND H3S FOR JUNE, 1949

Date	Time (PCT)	H3B (ft.)	H3S (ft.)
5	1345 - 1403	0.741	1.873
6	1404 - 1422	1.025	4.187
7	0808 - 0826	0.467	2.241
8	1411 - 1429	0.753	1.448
9	1547 - 1605	1.004	2.641
10	1400 - 1418	2.062	6.647
11	0800 - 0818	0.907	2.488
12	0600 - 0618	1.205	3.100
13	0600 - 0618	1.005	4.109
14	1442 - 1500	1.045	5.862
15	1448 - 1506	1.506	5.726
16	1453 - 1511	1.312	9.032
17	1734 - 1752	1.262	9.979
18	1123 - 1141	0.865	3.973
19	1148 - 1206	0.839	3.753
20	1155 - 1213	0.878	3.282
21	2208 - 2226	0.702	1.511
22	1005 - 1023	0.486	1.374
23	1010 - 1028	1.127	5.163
24	1010 - 1028	0.646	3.364
25	1731 - 1749	1.465	8.357
26	1134 - 1152	1.023	8.672
27	1145 - 1203	0.745	4.146
28	1223 - 1241	0.822	3.319
29	1106 - 1124	0.719	1.857
30	1136 - 1154	0.861	4.735

SUMMARY OF H3B AND H3S FOR JULY, 1949

Date	Time (PCT)	H3B (ft.)	H3S (ft.)
1	1948 - 2006	0.660	1.509
2	1400 - 1418	0.470	1.207
3	1355 - 1413	0.866	2.143
4	1407 - 1425	0.798	2.695
5	1355 - 1413	0.644	2.017
6	1824 - 1842	0.915	2.323
7	1223 - 1241	0.319	3.498
9	0246 - 0304	0.860	3.923
18	1352 - 1410	0.494	3.419
19	1715 - 1733	0.130	6.459
20	1122 - 1140	1.062	2.172
21	1125 - 1143	0.733	3.343
22	1540 - 1558	1.098	5.164
23	1545 - 1603	0.753	2.586
24	1547 - 1605	0.635	2.392
25	0949 - 1007	0.877	6.080
26	1322 - 1340	0.730	4.686
27	1457 - 1515	0.983	4.561
28	1505 - 1523	1.049	4.595
29	1506 - 1524	0.957	2.536
30	1827 - 1845	0.932	2.655
31	1230 - 1248	0.681	2.153

SUMMARY OF H3B AND H3S FOR AUGUST, 1949

Date	Time (PCT)	H3B (ft.)	H3S (ft.)
1	1242 - 1300	0.876	3.214
2	1457 - 1515	0.652	1.713
3	1436 - 1454	0.733	1.474
4	1530 - 1548	0.698	3.553
5	1528 - 1546	1.147	3.558
6	1504 - 1522	0.696	1.299
7	1505 - 1523	1.089	6.107
8	1503 - 1521	1.000	5.539
9	1522 - 1540	0.960	2.860
10	1521 - 1539	0.484	4.662
11	1520 - 1538	0.419	2.213
12	1529 - 1547	0.565	1.867
13	1530 - 1548	0.769	3.641
14	1528 - 1546	0.887	3.190
15	1529 - 1547	0.524	0.876
16	1541 - 1559	0.324	1.207
17	1541 - 1559	0.574	1.555
18	1541 - 1559	0.515	2.128
19	0942 - 1000	0.627	1.162
20	1211 - 1229	0.567	1.480
21	1210 - 1228	0.240	1.972
22	1208 - 1226	0.281	2.128
23	1131 - 1149	0.288	1.586
24	1130 - 1148	0.313	1.088
25	1131 - 1149	0.500	2.943
26	1129 - 1147	0.721	2.445
27	1137 - 1155	0.824	2.321
28	1139 - 1157	0.941	3.385
29	1140 - 1158	0.590	2.158
30	1201 - 1219	0.663	1.711
31	1141 - 1159	0.506	2.891

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1 ORIGINATING ACTIVITY *(Corporate author)*
Naval Postgraduate School
Monterey, California 93940

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b. GROUP

3 REPORT TITLE
Spectral Analyses of Waves and Associated Bottom Pressures Off Point Sur, California

4 DESCRIPTIVE NOTES *(Type of report and inclusive dates)*
Thesis

5 AUTHOR(S) *(First name, middle initial, last name)*
Boyden Tracy Steele

6 REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
June 1968	86	11

8a. CONTRACT OR GRANT NO.

b. PROJECT NO.

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)

9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*

10. DISTRIBUTION STATEMENT
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11. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY
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13 ABSTRACT

A time series of pressure variations was obtained by digitizing analogue records of bottom pressure, recorded at Pt. Sur, California, during the periods November, December, and January, 1947-1948, and June, July, and August, 1949. The power spectrum of the pressure variations was found via the amplitude spectra obtained by means of the fast Fourier transform. This spectrum was then smoothed by averaging over several frequency bands and confidence limits were assigned.

Surface wave power spectra were inferred from the pressure power spectra and significant wave heights were estimated from these, after applying a procedure designed to remove noise.

Values of significant height on the bottom and at the surface are displayed in tabular form and plotted versus time for the selected periods January, 1948, and August, 1949. The spectral patterns of wave activity show the transient nature of the energy due to storm swell and local winds.

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Wave Pressure Records						
Bottom Pressures						
Significant Height, Graphic Display						
Fast Fourier Transform						
Digital Analysis						

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